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V-Tanks TSF-09/18 Calendar Year 2003/2004 Early Remedial Action Activities Summary Report for Waste Area Group 1, Operable Unit 1-10

August 2004

Idaho Completion Project

Bechtel BWXT Idaho, LLC

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August 2004

Idaho Completion Project
Idaho Falls, Idaho 83415

Prepared for the
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Assistant Secretary for Environmental Management
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Approved by

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ABSTRACT

This report summarizes the early remedial action activities performed at the Technical Support Facility-09/18 (also known as the V-Tank area west of Test Area North-633) during Calendar Years 2003 and 2004. The report includes both the evaluation of soil samples within the area of contamination and a description of the isolation of Tank V-9 from TAN-616 and the other V-Tanks. The results of this work demonstrate that Cs-137 is the only contaminant of concern in regards to human health and the environment; data indicate that the risk from other contaminants is below the threshold values of 1×10^{-4} cancer risk or hazard quotient of 1.0. As such, Cs-137 can be used to establish three-dimensional remedial action dig maps and post-remediation risk characterization. Use of Cs-137 contaminant concentrations as the sole indicator of risk greatly simplifies post-excavation analysis of the residual soil surfaces to verify that soil excavation meets the final remediation goal. The report includes contaminant profiles and proposed dig maps for soil excavation within the area of contamination associated with the Test Area North V-Tanks.

EXECUTIVE SUMMARY

The purpose of this report is to compile information into a single source addressing the Waste Area Group (WAG) 1 early remedial action (ERA) activities performed at the Technical Support Facility (TSF) 09/18 and TSF-21 sites during 2003/2004. The primary goal of this report is to provide a direction for completion of the remediation. The document serves as an information source for the Remedial Design and Remedial Action Work Plan Addendum 2 (DOE-ID 2003).

The report describes all preliminary work completed in Calendar Years (CYs) 2003/2004 on the WAG-1 ERA activities, including direct sampling efforts and the subsequent sample collection activities. The ERA activities associated with this project include:

- A two-phased sample regimen designed to better define the TSF-09/18 and TSF-21 site areas of contamination (AOC) and to characterize soils in the AOCs

- Isolation of the V-9 tank outlet line from Test Area North (TAN) -616.

Details associated with these ERA activities are discussed below.

The ERA sampling activities focused on the contaminated soils that form the basis of the AOCs. The intent was to establish the extent of soils that exceed the final remediation goals (FRGs). The AOCs encompass TSF-09 (Tanks V-1, V-2, and V-3), TSF-18 (Tank V-9), and TSF-21 (Valve Pit #2), particularly the soils that surround these structures and associated piping networks. The main sources of contamination in these AOCs are from:

- A known spill from a tanker truck (in 1982)

- Potential leaks around Valve Box #1 (and other associated piping in the area)

- Previous removal actions in Valve Box #2 that resulted in known accidental leaks out of the valve box

- Suspected pipe leaks around Valve Box #2

- A piping tee from an underground waste pipe from building TAN-633 that joins into the pipeline connecting Valve Pit #1 and #2.

Resulting sample analytical data from the ERA sampling activity is evaluated in this report along with historical sample information to provide a comprehensive analysis of soils in the AOC. The historical soil data that was used included both past soil-sampling activities in the AOC and Fiscal Year (FY) -03 sampling data obtained during decontamination and decommissioning (D&D) of TAN-616 (when soil samples were taken from the AOC). Use of this historical data provides a more thorough characterization of species not previously targeted in the AOC soil sampling effort.

On the basis of this comprehensive data analysis, a new risk assessment, begun in FY-03 and finished in FY-04, was performed. A summary of the new risk assessment is included in this report. The purpose of this new risk assessment was to incorporate the new data into a risk screen to determine if any additional COCs needed to be added to the FRG. The new risk assessment focused on determining whether or not Cs-137 analysis could be used to identify when excavation of the AOC could be considered complete. This new risk assessment was based on a prescribed risk-based screening technique for WAG 1 (Van Horn and Stacey, 2004).

Results of the risk assessment found that no additional contaminants needed to be added to the FRG; Cs-137 at 23.3 pCi/g remained the only FRG. As a result, a contamination map was developed based on Cs-137 alone. This map was based on Cs-137 data used in the risk assessment, as well as additional in situ gamma scan surveys completed over the TSF-09/18 and TSF-21 sites and the ERA Phase II vertical radiological profiling of the area (via downhole logging at various locations). The resulting contamination map provides a three-dimensional image that can be rotated for viewing from any angle, with the boundaries of the plume (set at a measured Cs-137 concentration of 23.3 pCi/g). The three-dimensional image provides a depiction of the contamination footprint and subterranean elevation.

The contamination map confirms the existence of the three main sources of contamination:

- <u>TSF-9/18 around the V-Tanks</u>—a known spill from a tanker truck in 1982, potential leaks around Valve Box #1 and other associated piping in the area

- <u>TSF-21 (Valve Box #2)</u>—previous removal actions resulted in known accidental leaks out of the valve box and suspected pipe leaks were both causes of soil contamination

- <u>The piping tee from an underground waste pipe from building TAN-633 that joins into the pipeline connecting Valve Pit #1 and #2</u>—this area was found to have contamination from a probable leak during 2003/2004 D&D operations.

On the basis of the contamination map, excavation maps were established that would allow the FRG to be realized. These excavation maps are included in this report.

The AOC database was also used to determine the waste profile for excavated soil. A 90% upper confidence limit (UCL) of the mean toxicity characteristic leaching procedure (TCLP) data was calculated to determine if D-codes (characteristic codes) applied to the excavated soil; the data indicated that no characteristic codes would apply to excavated soil. A second analysis determined the 95% UCL of the mean for total concentration data to provide a profile for the INEEL CERCLA Disposal Facility (ICDF).

The second ERA activity is associated with isolation of the outlet line from Tank V-9. This activity included:

- Removing the sand filter and abandoned tank supports located on the east side of TAN-616 (in the area requiring excavation for V-9 outlet line isolation)

- Visual investigations of pipe interiors associated with V-9

- Excavation to expose the outlet line where it penetrates the building wall

- Cutting and removing a section of the line approximately 6 in. from the wall

- Insertion of a polyethylene plug into the V-9 outlet line

- Capping the V-9 outlet line, after plug insertion.

The purpose of the plug insertion was to clear the outlet line of its residual contents by pushing the contents back to Tank V-9. However, during plug insertion, it was found that the outlet line had been previously capped in an area closer to Tank V-9. As a result, the residual waste in the V-9 outlet line has been consolidated and isolated in a small portion of the V-9 outlet line. The capped area will be hot-tapped to remove its contents prior to removal of the V-9 outlet line (currently scheduled for CY-4).

CONTENTS

FIGURES

TABLES

ACRONYMS

AOC	area of contamination
BBWI	Bechtel BWXT Idaho, LLC
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	contaminant of concern
CY	calendar year
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DPM	disintegrations per minute
DS	deep sample
EPA	U.S. Environmental Protection Agency
ERA	early remediation action
EVS	Environmental Visualization System
FFA/CO	Federal Facility Agreement and Consent Order
FRG	final remediation goal
FSP	Field Sampling Plan
FY	fiscal year
GPR	ground-penetrating radar
GSLS	gamma spectroscopy logging system
HPGe	high-purity germanium
ICDF	INEEL CERCLA Disposal Facility
IET	Initial Engine Test
INEL	Idaho National Engineering Laboratory
INEEL	Idaho National Engineering and Environmental Laboratory
JSA	job safety analysis
LOFT	Loss-of-Fluid Test (Facility)

MCP	management control procedure
OU	operable unit
PCB	polychlorinated biphenyl
PRG	preliminary remediation goal
RA	remedial action
RCRA	Resource Conservation and Recovery Act
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
RWP	radiological work permit
SMC	Specific Manufacturing Capability (Facility)
SOW	Statement of Work
SS	shallow sample
SVOC	semivolatile organic compound
SWP	safe work permit
TAN	Test Area North
TCLP	toxicity characteristic leaching procedure
TDEMI	time-domain electromagnetic induction
TPR	technical procedure
TSF	Technical Support Facility
TSR	technical safety requirement
UCL	upper confidence limit
UST	underground storage tank
VOC	volatile organic compound
WAC	Waste Acceptance Criteria
WAG	waste area group
WM	Waste Management

V-Tanks TSF-09/18 Calendar Year 2003/2004 Early Remedial Action Activities Summary Report for Waste Area Group 1, Operable Unit 1-10

1. INTRODUCTION

1.1 Purpose

The purpose of this report is to compile information into a single source addressing the Waste Area Group (WAG) -1 early remedial action (ERA) activities performed at the Technical Support Facility (TSF) -09/18 and TSF-21 sites during Calendar Years 2003 and 2004. This report describes all preliminary work completed to direct sampling efforts and the subsequent sample collection/soil excavation activities.

The ERA activities addressed by this report were performed in accordance with the Comprehensive Remedial Design/Remedial Action Work Plan Addendum for the V-Tanks Early Remedial Action for the Test Area North, Waste Area Group 1, Operable Unit 1-10, Group 2 Sites (DOE-ID 2003a), along with all Remedial Design/Remedial Action (RD/RA) Work Plan supporting documents. These include the:

- *Field Sampling Plan for V-Tanks Early Remedial Action at Waste Area Group 1, Operable Unit 1-10* (DOE-ID 2003b)
- *Health and Safety Plan for the TSF-09/18 (V-Tanks) and TSF-21 Early Remedial Action Field Sampling, Equipment Removal and Disposal at Test Area North, Waste Area Group 1, Operable Unit 1-10* (Lewis 2004)
- *Waste Management Plan for V-Tanks Early Remedial Action for the Test Area North, Waste Area Group 1, Operable Unit 1-10, Group 2 Sites* (INEEL 2004)
- *Operations and Maintenance Plan for Test Area North, Operable Unit 1-10* (DOE-ID 2001)
- *Institutional Control Plan for the Test Area North Waste Area Group 1* (INEEL 2000).

Early remedial activities addressed by this report include the following:

- Isolating Tank V-9 and relocating the sand filter
- Removing debris (vis., concrete tank cradles and piping) that would interfere with excavation activities associated with the isolation of Tank V-9
- Sampling surrounding soils to further characterize the V-Tanks area of contamination (AOC).

The purpose of the V-9 isolation, sand filter relocation, and debris removal activities were to eliminate further intrusion of waste liquids and sediments into the V-Tanks, while also eliminating any pieces of equipment that may complicate the proposed excavation activity that is scheduled for Calendar Year (CY) 2004. Included in these activities is the inspection of piping connected to the V-Tanks, along with the collection of any residual waste material found in these lines (if the waste cannot be simply transferred to the tanks, as part of the isolation effort). The purpose of the additional soil sampling was to better define the degree of soil excavation required as part of the contaminated soil remediation effort.

The resulting sample analytical data is evaluated in this report along with historical sample information to provide a comprehensive analysis of AOC soils, with discussion and recommendation on future remedial activities in the AOC. Tank V-9 isolation activities are also discussed in this report. Completion of this report meets the submittal requirement for a "V-Tanks Piping Isolation and Soil Sampling Data Compilation Report," as identified in Table 6-1 of the RD/RA Work Plan Addendum (DOE-ID 2003a).

1.2 Report Organization

- Section 1—Describes the purpose and organization of this report and provides background and historical information concerning the Operable Unit (OU) 1-10, TSF-09, TSF-18, and TSF-21 sites
- Section 2—Provides a summary of the ERA activities conducted at the TSF-09/18 and TSF-21 sites during Calendar Year 2003 and early 2004
- Section 3—Describes the TSF-09/18 and TSF-21 sites ERA subsurface investigation activities during Calendar Year 2003
- Section 4—Describes the ERA radiological profiling activities performed at the TSF-09/18 and TSF-21 sites and general area during Calendar Year 2003
- Section 5—Describes logic used for the development of ERA 2003 sample locations and identifies locations via area maps developed for sampling activities
- Section 6—Identifies soil sampling activities at the TSF-09/18 and TSF-21 sites during Calendar Year 2003
- Section 7—Provides historical information addressing previous sampling activities at the TSF-09/18 and TSF-21 sites
- Section 8—Provides a summary of 2003 ERA sample analysis data interpretation and a discussion on direction of future remedial action at the TSF-09/18 and TSF-21 sites based on that interpretation
- Section 9—Identifies activities completed relative to V-9 tank isolation
- Section 10—Provides a list of reference material used in this report
- Appendix A—Report from Sage Earth Science addressing geophysical survey activities and results in the TSF-09/18 and TSF-21 sites and surrounding areas
- Appendix B—Waste Area Group 1, Operable Unit 1-10, Group 2 soil surface in situ gama scan results report
- Appendix C—TSF-09/18 and TSF-21 sites Waste Area Group 1, Operable Unit 1-10, V-Tank area soils vertical profiling report
- Appendix D—TSF-09/18 historical soil sampling results
- Appendix E—TSF-21 historical soil sampling results
- Appendix F—Fiscal Year 2003 CERCLA V-Tank soil sampling results
- Appendix G—Fiscal Year 2003 Decontamination and Decommissioning soil sampling results
- Appendix H—Risk-based soil screening

- Appendix I—Field copies of radiological survey reports and radiological control daily reports.
- Appendix J—Drilling/Sampling Activity Radiological Survey Reports/Radiological Control Daily Log Sheets

1.3 Idaho National Engineering and Environmental Laboratory Site Description

The Idaho National Engineering and Environmental Laboratory (INEEL), formerly the National Reactor Testing Station, encompasses 2,305 km^2 (890 mi^2), and is located approximately 51.5 km (32 mi) west of Idaho Falls, Idaho. The U.S. Department of Energy Idaho Operations Office has responsibility for the INEEL and designates authority to operate the INEEL to government management and operating contractors.

The United States Atomic Energy Commission, now the U.S. Department of Energy (DOE), established the National Reactor Testing Station (now the INEEL) in 1949 as a site for building and testing a variety of nuclear facilities. The INEEL also has been the storage facility for transuranic radionuclides and radioactive low-level waste since 1952. At present, the INEEL supports the engineering and operations efforts of DOE and other federal agencies in areas of nuclear safety research, reactor development, reactor operations and training, nuclear defense materials production, waste management technology development, energy technology and conservation programs, and DOE long-term stewardship programs.

1.4 Background and Project Site Description

The INEEL is a U.S. government-owned test site managed by the DOE and located in southeastern Idaho 51.5 km (32 mi) west of Idaho Falls, as shown in Figure 1-1. The laboratory encompasses approximately 2,305 km^2 (890 mi^2) of the northeastern portion of the Eastern Snake River Plain. The Eastern Snake River Plain is a relatively flat, semiarid sagebrush desert with predominant relief manifested either as volcanic buttes jutting up from the desert floor or as unevenly surfaced basalt flows or flow vents and fissures (DOE-ID 1999). Elevations on the INEEL site range from 2,003 m (6,572 ft) in the southeast to 1,448 m (4,750 ft) in the playas (Figure 1-2) with an average elevation of 1,516 m (4,975 ft). Drainage within and around the plain recharges the Snake River Plain Aquifer, which flows beneath the INEEL and the surrounding area (DOE-ID 1997). The top of the aquifer slopes from about 61 m (200 ft) below the surface at TAN to about 183 m (600 ft) below the surface at the Radioactive Waste Management Complex. The aquifer is overlain by lava flows and sediment (DOE-ID 1999).

The U.S. Atomic Energy Commission initially established the facility in 1949 as the National Reactor Testing Station for nuclear energy research and related activities. In 1952, the facility was expanded to accept shipments of transuranic radionuclides and low-level waste. It was named the Idaho National Engineering Laboratory (INEL) in 1974. In 1997, the INEL was renamed the INEEL to reflect its expanded mission to include a broader range of engineering and environmental management activities. Currently, the INEEL is primarily used for nuclear research and development and waste management (DOE-ID 1999).

In November 1989, the U.S. Environmental Protection Agency (EPA) placed the INEEL on the "National Priorities List of the National Oil and Hazardous Substances Pollution Contingency Plan" (54 FR 48184) because of confirmed contaminant releases to the environment. In response to this listing, the Agencies, composed of the DOE, EPA, and the Idaho Department of Environmental Quality, negotiated the *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory* (DOE-ID 1991) and the *Action Plan for Implementation of the Federal Facility Agreement*

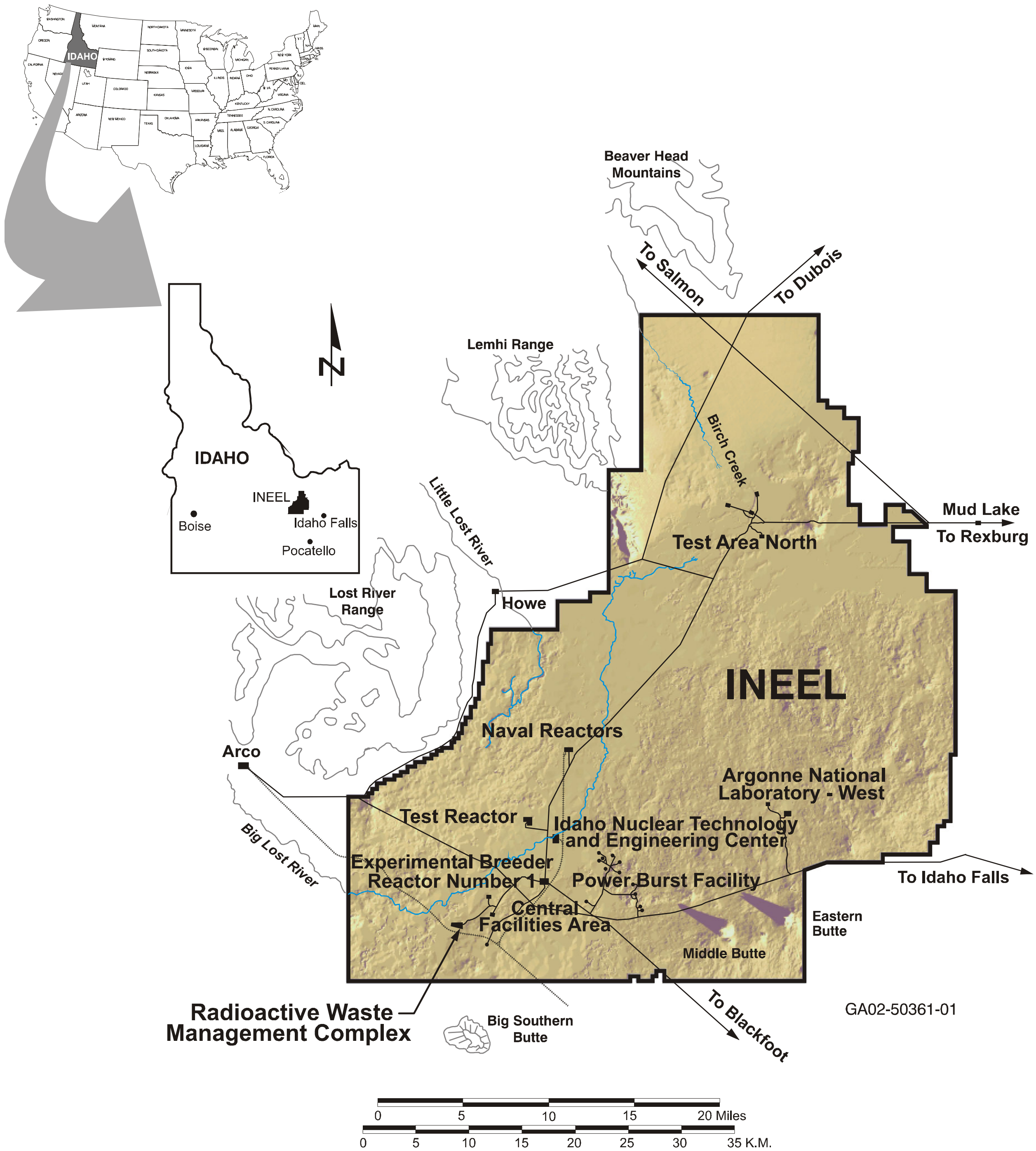

Figure 1-1. Location of the Idaho National Engineering and Environmental Laboratory.

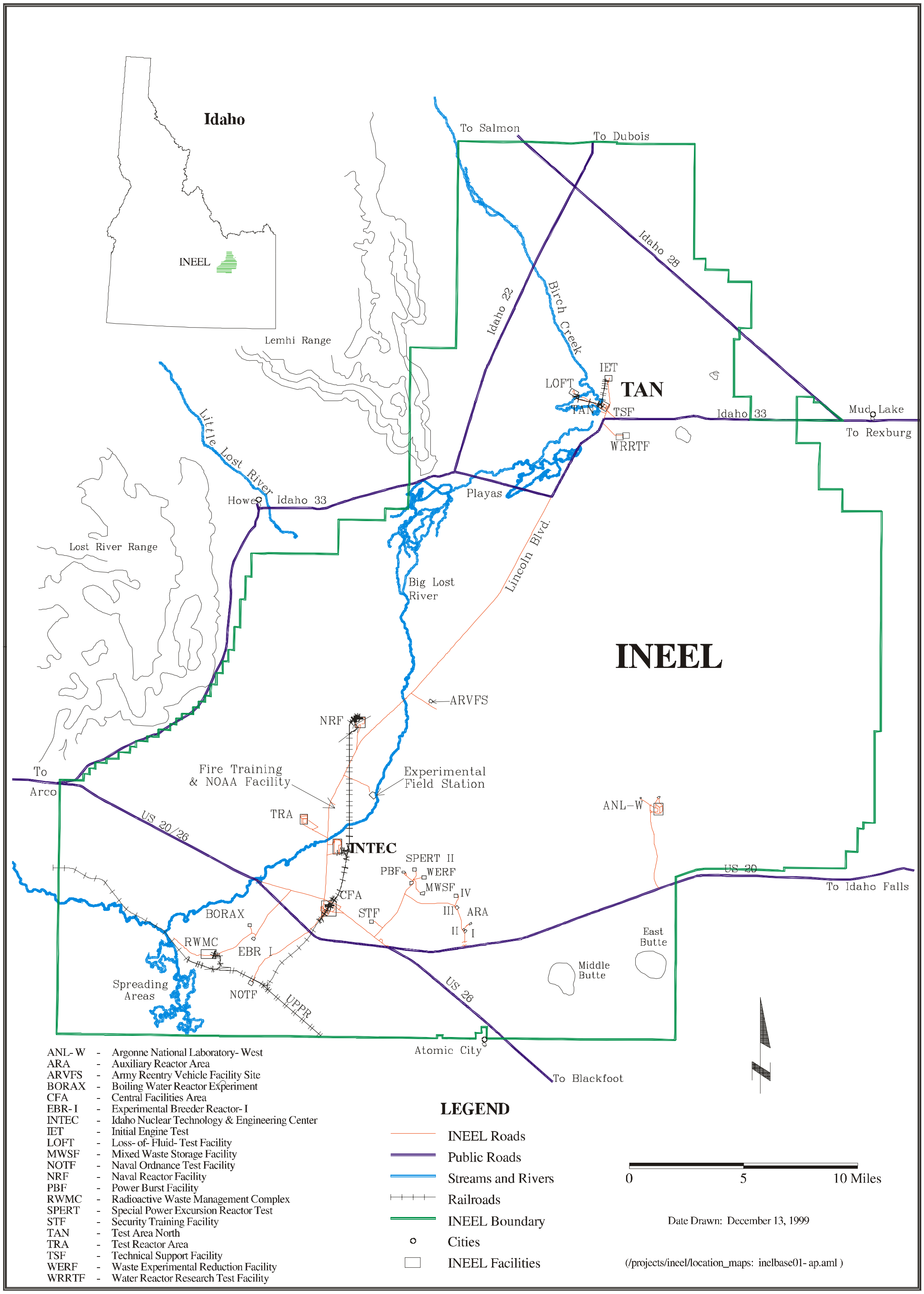

Figure 1-2. Location of Test Area North at the Idaho National Engineering and Environmental Laboratory.

and Consent Order for the Idaho National Engineering Laboratory (DOE-ID 1991a). The Federal Facility and Consent Order (FFA/CO) and the Action Plan were signed in 1991 by the Agencies, thereby establishing the procedural framework and schedule for developing, prioritizing, implementing, and monitoring response actions at the INEEL in accordance with "Comprehensive Environmental, Response, Compensation and Liability Act of 1980 (CERCLA/Superfund)" (42 USC § 9601 et seq.); "Resource Conservation and Recovery Act (Solid Waste Disposal Act)" (42 USC § 6901 et seq.); and the Idaho "Hazardous Waste Management Act of 1983" (Idaho Code § 39-4401 et seq.) (DOE-ID 1991).

To better manage cleanup activities, the INEEL was divided into 10 WAGs. Test Area North is designated as WAG 1, which includes the TSF, the Initial Engine Test (IET) Facility, the Loss-of-Fluid Test (LOFT) Facility, the Specific Manufacturing Capability (SMC) Facility, the Water Reactor Research Test Facility fenced areas, and the immediate areas outside the fence lines (DOE-ID 1999).

Located in the north-central portion of the INEEL (Figure 1-2 and Figure 1-3), TAN was constructed between 1954 and 1961 to support the Aircraft Nuclear Propulsion Program, which developed and tested designs for nuclear-powered aircraft engines until the research was terminated by congress in 1961. The area's facilities were then converted to support a variety of other DOE research projects. From 1962 through 1986, the area was principally devoted to the LOFT Facility, which was used to perform reactor safety testing and studies. Beginning in 1980, the area was used to conduct research and development with material from the 1979 Three Mile Island reactor accident (DOE-ID 1998). During the mid-1980s, the TAN Hot Shop (DOE-ID 1999) supported the final tests for the LOFT program. Current activities include the manufacture of armor for military vehicles at the SMC Facility, and nuclear inspection and storage operations at TSF. The IET Facility has been deactivated, decontaminated, and decommissioned by the INEEL Deactivation, Decontamination, and Decommissioning program.

In 1991, the FFA/CO established 10 OUs within WAG 1, consisting of 94 potential release sites, which are identified in the *Comprehensive Remedial Investigation/Feasibility Study for the Test Area North Operable Unit 1-10 at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 1997). The sites include various types of pits, numerous spills, ponds, aboveground and underground storage tanks (USTs), and a railroad turntable. The comprehensive remedial investigation/feasibility study (RI/FS) was initiated in 1995 to determine the nature and extent of the contamination at TAN. The FFA/CO defines OU 1-10 as the comprehensive WAG 1 RI/FS (DOE-ID 1997), which culminated with the *Final Record of Decision for Test Area North, Operable Unit 1-10* (DOE-ID 1999). Final remediation goals were established in the Record of Decision (ROD) based on long-term risks associated with Cs-137 activity. This report details the soil sampling activities conducted this year to support the future excavation and removal of the OU 1-10 V-Tanks (TSF-09 and TSF-18). Technical Support Facility-21 was removed in 1993; however, this report also details soil sampling activities in this area.

The TSF Intermediate-Level (Radioactive) Waste Disposal System (TSF-09) and the TSF Contaminated Tank (TSF-18) are situated in an open area east of TAN-616 and north of TAN-607 (Figure 1-4). TSF-09 consists of three abandoned USTs. TSF-18 consists of one abandoned UST and a concrete sand filter (Figure 1-5). The V-Tanks (V-1, V-2, V-3, and V-9) at TSF-09 and TSF-18 were installed in the early 1950s as part of the system designed to collect the following for treatment:

- Radioactive liquid effluents generated in the hot cells, laboratories, and decontamination facilities at TAN
- Waste from the IET Facility.

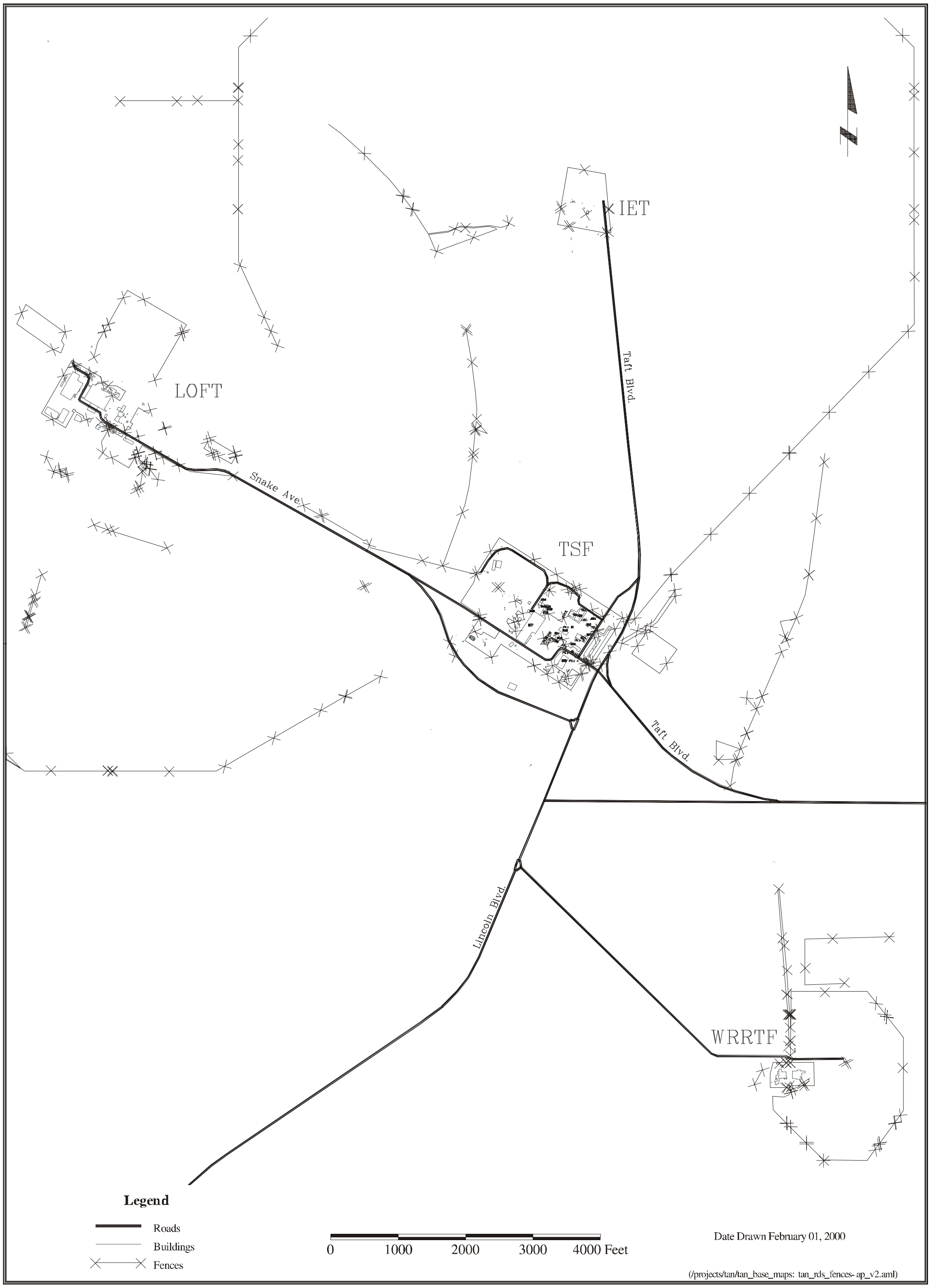

Figure 1-3. Test Area North facilities.

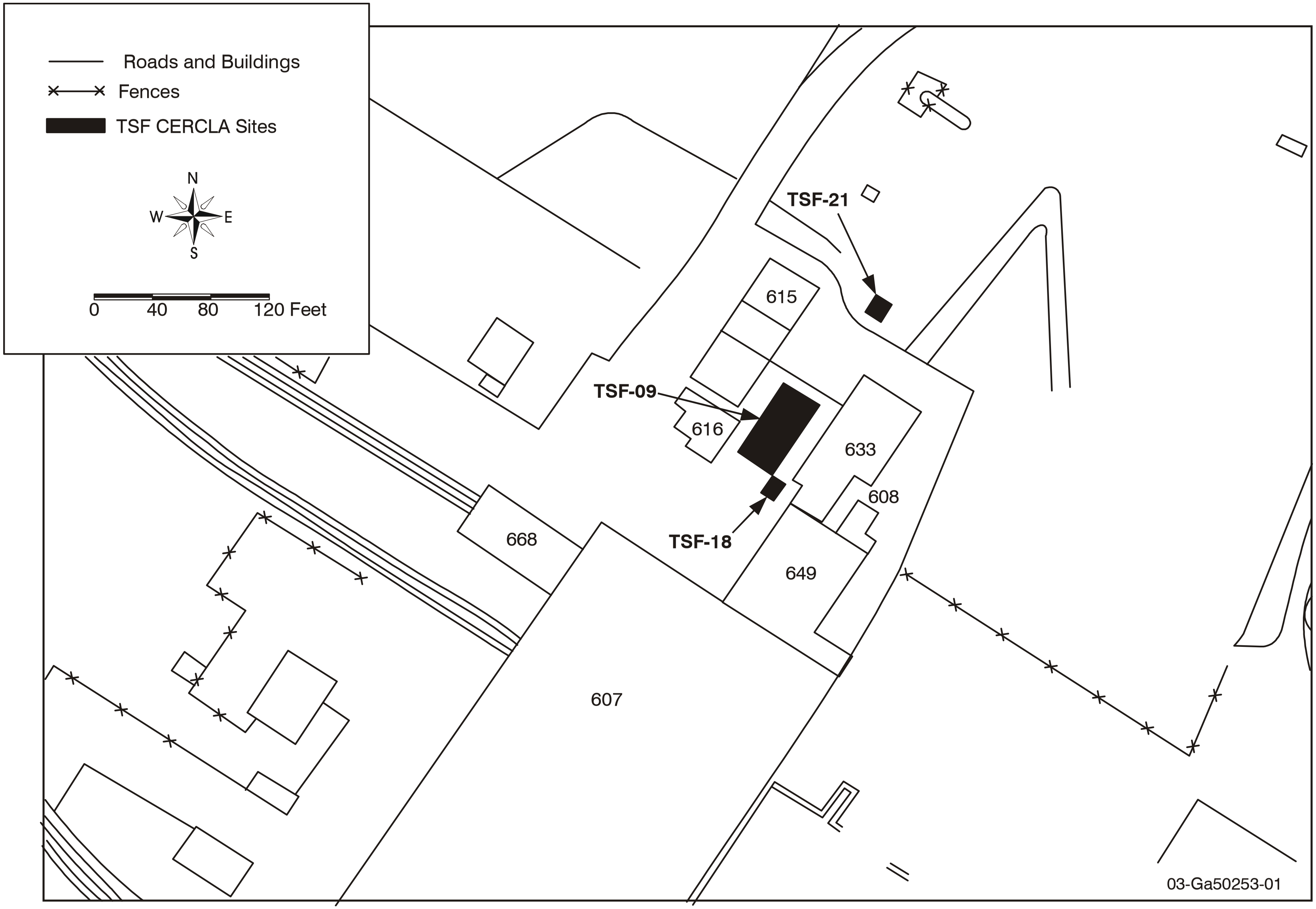

Figure 1-4. Location of TSF-09, TSF-18, and TSF-21.

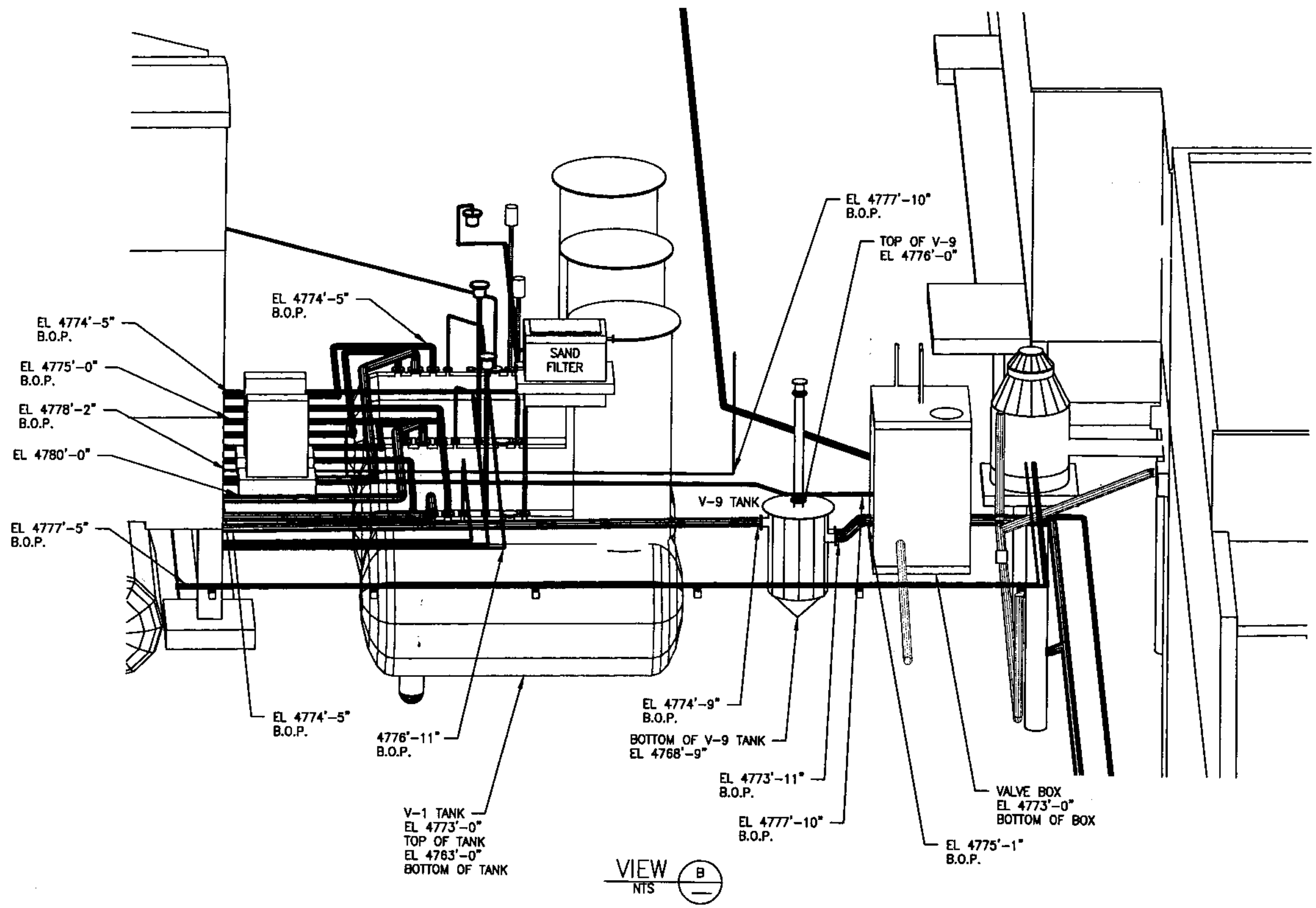

Figure 1-5. Diagram of TSF-09, TSF-18, and sand filter.

Based on process knowledge and work site use, the RI/FS concluded that the known or suspected types of contamination at the work sites include metals (barium, cadmium, chromium, lead, mercury, and silver), volatile organic compounds (VOCs) (trichloroethene, 1,1,1-trichloroethane, carbon tetrachloride, and acetone), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and radionuclides (Cs-137, Co-60, Sr-90, and various isotopes of plutonium and uranium) (DOE-ID 1997).

The history and uses of the TSF-09 tanks (Tanks V-1, V-2, and V-3 [Figure 1-6]) are better documented than the history and uses of Tank V-9. Since their installation, the three 37,850-L (10,000-gal) tanks have been used to store radioactive liquid wastes generated at TAN. The waste collected in the tanks was treated in the evaporator system located in TAN-616. Treatment residues were sent to the TSF injection well or the PM-2A tanks at TSF-26. After the evaporator system in TAN-616 failed in 1970, waste stored in the TSF-09 tanks was sent directly to the PM-2A tanks. After 1975, waste that had accumulated in the TSF-09 tanks was pumped out and shipped to the Idaho Chemical Processing Plant by tanker truck. Spills during tank operation, and runoff from an adjacent cask storage pad, reportedly contaminated surface soils surrounding the tank.

In 1968, a large quantity of oil was discovered in Tank V-2, and the tank was taken out of service. The oil was removed from Tank V-2 in 1981, and the liquid in Tanks V-1, V-2, and V-3 was removed in 1982. During removal of the liquid, approximately 6,434.5 L (1,700 gal) were accidentally allowed to drain onto the ground. The liquid puddled in a soil depression along the west side of the tank manways and flowed north out of the radiologically controlled area through a shallow drainage ditch. Cleanup operations removed approximately 3.8 m^3 (128 ft^3) of radioactive soil in a 0.9-m^2 (10-ft^2) area north of the tanks and outside the posted Radiological Control (RadCon) zone, and the excavation was backfilled with clean soil. There are no indications that clean soil was placed in the area around the tanks following the spill. The tanks have not been used since the 1980s, although liquids (i.e., rainwater and snowmelt) have accidentally accumulated in Tank V-3 since the 1980s (DOE-ID 1997).

The aforementioned drainage ditch ran plant east between buildings TAN-616 and TAN-615 (Figure 1-4) (see Note). At the end of building TAN-615, the ditch ran plant north to the end of the building, then plant west along the building, then plant south along the building—approximately 1/3 the length of the building—and finally plant west away from the building and into a culvert. The terrain above the V-Tanks and west of the TAN-633 (Hot Cell area) sloped toward the ditch. An extensive review of the sample data for Cs-137 (via surface gamma analysis) was conducted over the entire area of the drainage ditch (with the exception of the upstream ditch area between TAN-616 and TAN-615, which was already earmarked for excavation). On the basis of this review, it appears that the concentration of Cs-137 in the drainage ditch had dropped below the actionable cleanup level of 23.3 pCi/g, before exiting into the culvert. Therefore, there is no technical basis for additional sampling of the culvert.

Note: The TAN-615 structure was demolished in 2002. Its inclusion in the text and in Figure 1-4 serves to show the approximate location of the drainage ditch.

The tank at TSF-18, referred to as Tank V-9 (Figure 1-7), is a 1,514-L (400-gal) stainless steel sump tank located approximately 2.1 m (7 ft) to 4.2 m (14 ft) below ground surface (bgs). Tank V-9 is accessible by a 15.2-cm (6-in.) diameter riser that extends to the ground surface. The conical tank is 42 in. in diameter in the center and extends approximately 2.1 m (7 ft) down to the tip of the cone. Based on information obtained during the remedial investigation, the tank contains approximately 0.9 m (3 ft) of sludge, 0.9 m (3 ft) of liquid, and 0.3 m (1 ft) of head space. The total volume of material in Tank V-9 was estimated at 1,216 L (320 gal). Radiation readings in the tank range from 9 mrem/h on contact just

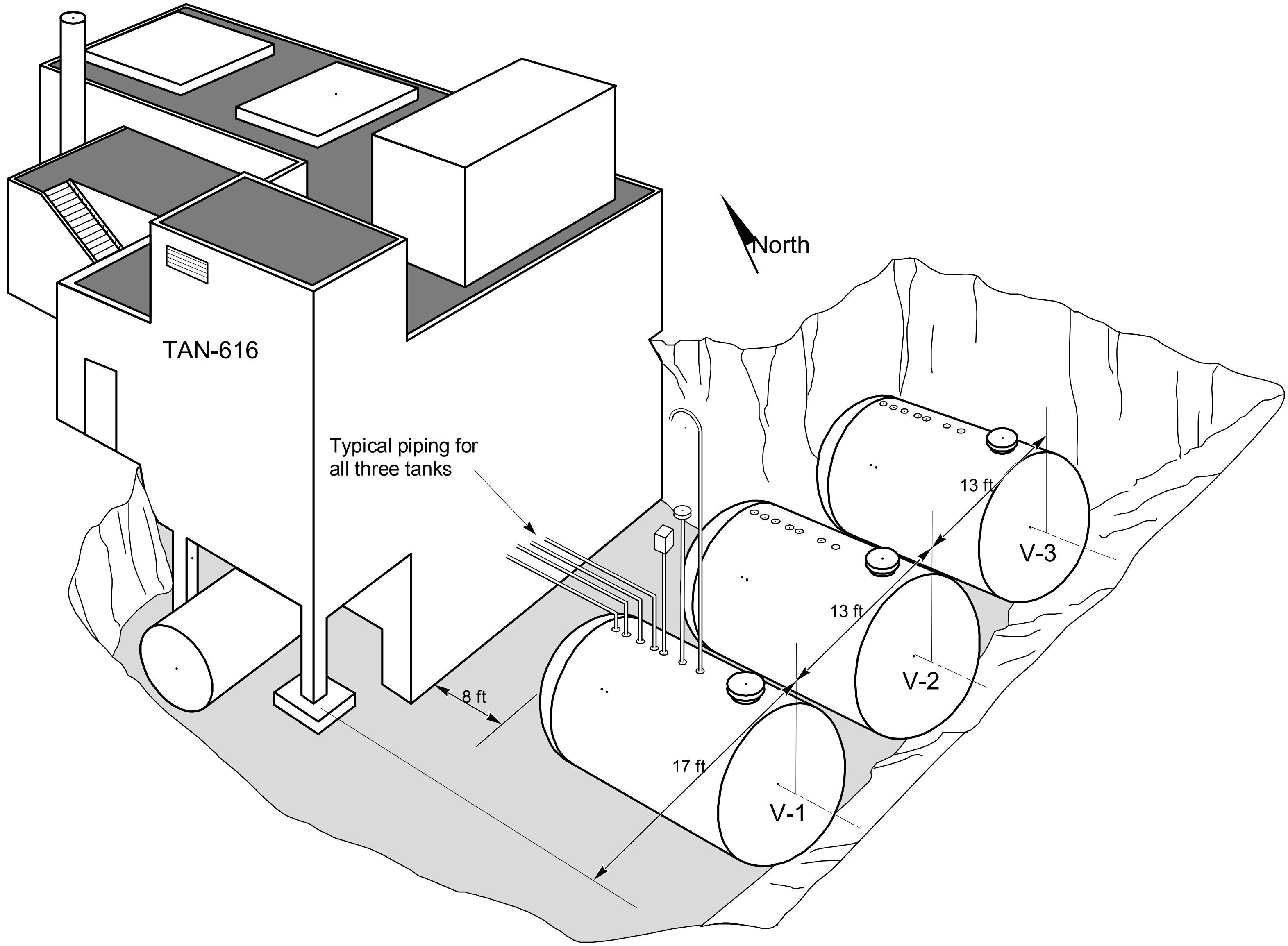

Figure 1-6. Diagram of Tanks V-1, V-2, and V-3.

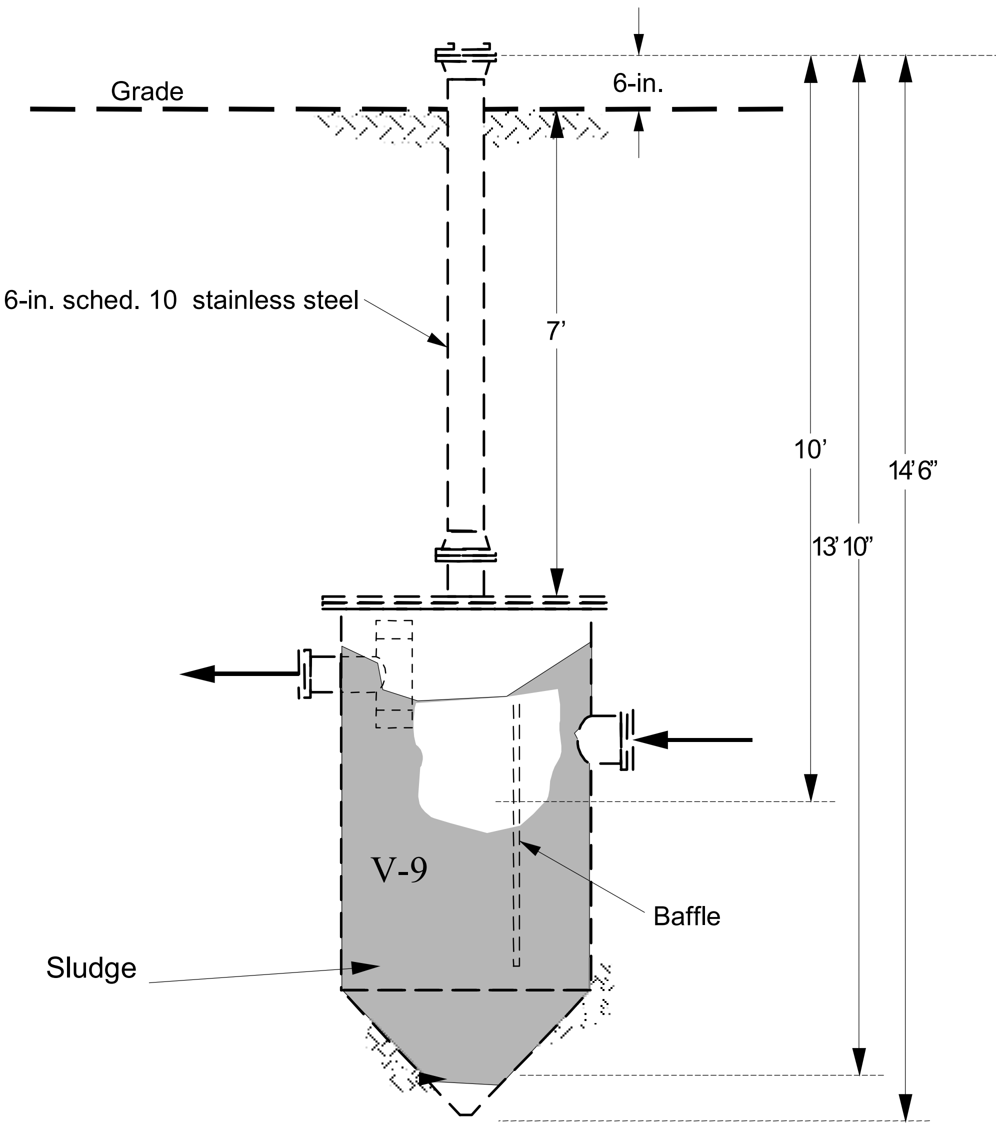

Figure 1-7. Diagram of Tank V-9.

inside the 15.2-cm (6-in.) riser to 10,500 mrem/h just inside the tank. The tank was installed in the early 1950s and was indicated as a sump tank in facility “as-built” drawings. The visual evidence collected during the remedial investigation is consistent with the tank configuration shown in earlier as-built drawings (DOE-ID 1997).

Results from sampling and analysis of Tank V-9 contents (performed during the remedial investigation) indicate that chemicals in the tank are very similar to those found in the tanks at TSF-09. High concentrations of Sr-90, Cs-137, Co-60, and trichloroethene detected during analysis are consistent with those found in the TSF-09 tanks during the Track 2 investigation in 1993. Internal visual evidence obtained with a remote camera during the remedial investigation indicates that the tank is in good condition (DOE-ID 1997). Eight additional samples were collected from Tank V-9 in May 2001 and analyzed for uranium isotopes and toxicity characteristic leaching procedure (TCLP) metals, including mercury. Data from this sampling activity was used to further address criticality concerns. No criticality concern was noted.

2. SUMMARY OF THE TSF-09/18, TSF-21 SITES EARLY REMEDIATION ACTIVITIES DURING CALENDAR YEARS 2003/2004

The ERA activities for Calendar Years 2003 and 2004 referred to in this report are associated with remediation of the Group 2 category of sites identified for WAG 1, OU 1-10. The Group 2 sites include the large V-Tanks (V-1, V-2, and V-3 associated with TSF-09), Tank V-9 (TSF-18), and (by overlap) the contaminated area around the valve pit (TSF-11). In accordance with proposed remediation identified in the Comprehensive RD/RAction Work Plan Addendum for V-Tank ERA (DOE-ID 2003a), plans for the ERA activities associated with these sites are as follows:

- Isolating Tank V-9 and relocating the sand filter
- Removing any debris that interferes with excavation plans necessary to isolate Tank V-9 (including the isolation, drainage, and/or removal of concrete cradles and piping structures surrounding Tank V-9)
- Sampling the soils surrounding the TAN V-Tanks, to further characterize the V-Tanks AOC.

Section 2 of this report is broken into three subsections that address each ERA activity mentioned above. Section 2.1 provides information on preliminary documentation activities supporting the above three actions. Section 2.2 summarizes the soil sampling and analysis activities that were used to further define the V-Tanks AOC. Section 2.3 provides information on isolation of Tank V-9, including the soil and debris removal activities associated with this isolation.

2.1 Initial Documentation Activities Supporting the Early Remedial Actions

Initial ERA activities for this year were associated with the review of documentation required to support fieldwork for the TSF-09/18 and TSF-21 sites. This included reviews of the project Cultural Resource evaluation, the Davis-Bacon case file, the Environmental Checklist, as well as other related documentation that was required for the ERAs. The reviews were completed to verify that the existing documentation was current and addressed the ERA scope for the year. The project *Field Sampling Plan for V-Tanks Early Remedial Action at Waste Area Group 1, Operable Unit 1-10* (DOE-ID 2003a) governing project activities—which directs sampling activities for the *Health and Safety Plan for the TSF-09/18 (V-Tanks) and TSF-21 Early Remedial Action Field Sampling, Equipment Removal and Disposal at Test Area North, Waste Area Group 1, Operable Unit 1-10* (Lewis 2004)—also was generated, reviewed, and approved. Drawings of the TSF Intermediate-Level (Radioactive) Waste Disposal System including TSF-09 (V-1, V-2, and V-3 tanks), TSF-18 (V-9 tank), and associated piping were obtained to identify tank and piping location in preparation for project ERA sampling activities. Field logs were obtained to record activities during field operations. Field logs obtained from the Environmental Restoration document control group are listed in Table 2-1.

Table 2-1. Field logs.

Logbook Title	Logbook Number	Logbook Purpose
Site Attendance Logbook	ER-074-2003	Record project site individual attendance
Field Team Leaders Daily Logbook	ER-026-2003	Project FTL Entries
Field Team Leaders Daily Logbook	ER-075-2003	Sample Team FTL Entries
Sample Logbook	ER-076-2003	Sample Activity Entries

2.2 Surrounding Soil Sampling, Evaluation, and Area of Contamination Determination

In preparation for evaluating the surrounding soil contamination, a review was performed on the previous subsurface survey data within the V-Tank area. The review revealed that more information would be required to collect soil samples and complete required excavation work in support of ERA scope.

In preparing for soil sampling activities, it was determined that due to the physical characteristics of the tank and piping layout, subsurface detection technology with the capability of determining piping location at depths approaching 20 ft would be required. A study of available technologies led to completion of geophysical surveys at the TSF-09/18 and TSF-21 sites and surrounding areas using technologies with the capability of detecting ferromagnetic materials at the project-required depths. The surveys were performed using magnetic field mapping and time-domain electromagnetic induction (TDEMI) technologies. Mapping showed geophysical anomalies in close proximity to locations indicated by INEEL drawings. Although the mapping activity did not provide the resolution hoped for, it did corroborate facility drawings as being fairly accurate. To complete the geophysical mapping, it was necessary to lay out and stake a working grid to provide location reference during mapping field activities. The grid also was used for Field Sampling Plan (FSP) Phase I surface radiological surveys.

Phase I soil surface in situ gamma scan surveys were completed over the TSF-09/18 and TSF-21 sites and surrounding areas using a collimated gamma spectrometer in a shielded configuration to limit surface gamma survey fields to a 12 to 20-ft diameter. The field view of the detector was set to match the grid space sizes determined by the project management team. The survey was done to better define radiological contaminant data in specific localized surface areas. Scanning was completed at 190 points over the entire area. Data from the scanning survey were used to bias Phase II subsurface sampling (drilling) locations to verify and better define the TSF-09/18 and TSF-21 CERCLA AOC. The data also confirmed historical information in areas where radioactive surface contamination had occurred.

Phase II sampling, completed to better define the AOC, consisted of (1) drilling in specific locations within the TSF-09/18 and TSF-21 sites and surrounding areas, (2) obtaining the vertical radiological profile of the area through downhole logging at these locations, and (3) collecting soil samples at specific locations. Two types of soil samples were taken; one type was used to determine waste management profiles (hazardous and radiological) for disposal purposes, and the other was used to determine the extent and relationship of radiological and hazardous soil contamination in the area to direct future remedial activities in removing contaminated soils from the AOC. Specific drilling locations were determined through evaluation of information obtained by project personnel addressing the following criteria:

1. Surface gamma data—obtained during Phase I activities identifying problematic surface contamination sites and potential sites for subsurface radiological contamination

2. Subsurface interference information—obtained through geophysical surveys, ground penetrating radar surveys, and review of existing facility drawings

3. Sites identified as potential contamination areas—determined from historical information relative to waste system operations.

As a result of this evaluation, two locations were chosen for drilling and coring that would penetrate to the area's underlying basalt formation. Eight locations also were selected for shallow drilling to a depth of 10 ft. After drilling, all boreholes were logged using high-resolution gamma-ray spectroscopy to provide a vertical profile of the radiological contamination. Vertical profiling was then used in selecting soil sample collection points where composite samples were taken from cores that were removed during drilling activities. The vertical profiling and soil sample data indicate that approximately 3,300 cubic yards of soil will require future removal for disposal at the INEEL CERCLA Disposal Facility (ICDF) as part of the TSF-09/18 and TSF-21 sites remediation.

2.3 Tank V-9 Isolation Activities

Tank V-9 outlet line isolation activities also required obtaining subsurface information in the V-Tanks area to support required excavation of the line. Geophysical survey and ground-penetrating radar (GPR) subsurface investigation activities did not provide definitive information on specific location of piping in the area. Facility drawings provide the most detailed information available in the area. These drawings showed the V-9 tank outlet line sloping away from the V-9 tank to the V-1, V-2, and V-3 collection tanks. Along with facility drawings, internal video recordings of the V-9 tank (showing water level) indicate the outlet line should have been dry. To verify the outlet line was dry, a video inspection was completed on the outlet line through a pipe penetration located in TAN-616. The inspection showed that the line was partially filled with water. Facility safety documentation did not permit movement of water in or out of the V-9 tank; therefore, no further isolation activities took place until the safety documentation was modified and changes were implemented. Once the facility safety documentation was modified and changes implemented, a polyurethane plug was pushed through the outlet line to within approximately 10 ft of the V-9 tank to isolate the outlet line. The truncated outlet line going into TAN-616 also was plugged to contain potential contamination.

3. TSF-09/18 AND TSF-21 SITES SUBSURFACE INVESTIGATION ACTIVITIES DURING CALENDAR YEAR 2003

The TSF Intermediate-Level (Radioactive) Waste Disposal System (TSF-09) and the TSF Contaminated Tank (TSF-18) and associated piping are situated in an open area east of TAN-616 and north of TAN-607 (Figure 1-4). TSF-09 (Figure 1-6) consists of three abandoned 10,000-gal cylindrical USTs that are approximately 18 ft long and 10 ft in diameter. Elevation at the bottom of the tanks is approximately 21 ft below grade. Elevation of most of the piping associated with these tanks ranges from 6 to 10 ft below grade. TSF-18 consists of one abandoned 400-gal UST (Figure 1-7) 4 ft in diameter and 7 ft tall. The tank is positioned vertically with its bottom approximately 14 ft below grade. Elevation of associated piping routed into and out of the tank is approximately 9 ft below grade.

INEEL personnel conducting subsurface investigations to provide guidance for excavation of subsurface components and piping historically use GPR technology. This technology is limited in its ability to identify subsurface anomalies to approximately 6 ft below grade. Larger fixtures and piping can be identified at greater depths, but the technology may not identify smaller items. Project personnel determined that technology with reliable detection capability at depths down to 20 ft would be required for this project. An investigation into available subsurface technology determined that magnetic field mapping and TDEMI technologies have the capability to map ferromagnetic materials at the depths we require. Preparations were made to bring a subcontractor onsite to provide subsurface surveys using the two identified technologies. Ground-penetrating radar surveys also were completed as a final check before actual sampling drilling and coring activities begin.

3.1 Site Plan Layout Survey

To provide spatial coordination for geophysical subsurface surveys, it was necessary to lay out a working grid and stake the entire TSF-09/18 and TSF-21 sites and surrounding areas. The site plan layout survey also provided spatial coordination for other project activities such as GPR subsurface surveys and soil surface in situ gamma scan area surveys. A map of the area was marked with proposed exterior boundaries, and an INEEL survey request was generated and sent to INEEL construction management personnel on January 9, 2003. The survey request directed marking of the total area in a grid with intersecting points at 10-ft intervals within the defined area. A map of the defined area (Figure 3-1) includes a total of 253 survey points marked at the site. Each survey point outside of the currently fenced AOC was marked with stakes. Survey points located within the fenced AOC were marked with paint on the ground surface. The layout survey work was completed on February 26, 2003.

3.2 Geophysical Surveys

The "Statement of Work for Sage Earth Science Waste Area Group 1 Subsurface Investigation Support" (SOW-646) was developed to address scope for performing geophysical surveys in support of scheduled WAG 1, OU 1-10 project objectives. The ERA work scope listed in the SOW was to locate buried tanks, associated piping, underground utilities, and other potential drilling and excavation hazards that might be encountered during soil sampling and excavation activities in the intermediate level radioactive waste feed subsystem V-Tanks area at TAN. The Statement of Work (SOW) was issued at the end of February 2003. Two technologies were requested for use in performing the surveys. Performance of a TDEMI survey and a high-resolution magnetic field survey were both required.

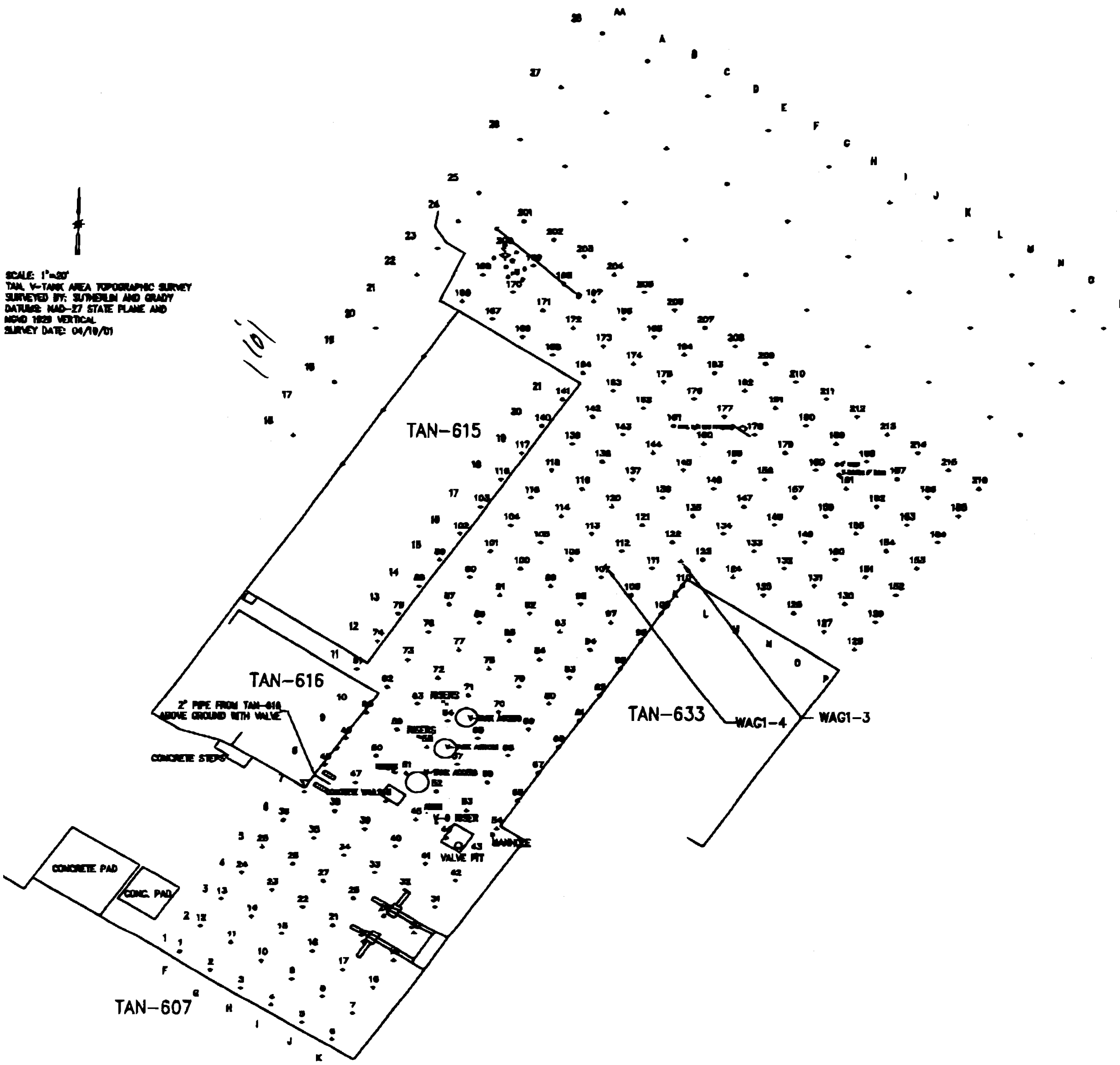

Figure 3-1. Site plan layout survey.

The TDEMI technology has the capability of determining the distribution of subsurface metallic objects. The technology consists essentially of metal detectors that respond not only to ferromagnetic metals and alloys, but also to a range of different metal types. A transmitter generates an electromagnetic pulse, which induces eddy current in metallic objects. The eddy current decay produces a secondary magnetic field measured by a receiver coil. The secondary field response is sensed and recorded. This method can detect a single 55-gal drum at a depth of over 10 ft, yet is relatively insensitive to nearby interference, which makes it a good choice for characterizing complex sites. The TDEMI data can be collected over all open areas of a site on a 0.5 × 0.25-m station spacing. The TDEMI data can be used to generate locations of metal objects, primarily steel tanks and pipes, within survey boundaries.

The magnetic field survey technology is a passive measurement of the earth's magnetic field. Compact magnetic objects produce location variations in the earth's field. By mapping the character of the field, it is possible to delineate the depth and location of objects producing those localized changes. The technology is more sensitive and has a higher resolution than competing metal detection methods in sensing buried ferrous objects. The data is collected on a 0.15 × 0.5-m data spacing over all open areas of a site resulting in approximately 50,000 data points per acre. The magnetic field data can be used to generate locations of buried ferrous objects (primarily steel tanks and pipes) and to develop depth estimates to individual objects within survey boundaries as necessary.

A contract was issued in early March 2003 to Sage Earth Science to complete geophysical surveys in accordance with the SOW. Glen Carpenter, of Sage, completed the work with the help of a subcontractor in his employ. Survey work at the TSF-09/18 and TSF-21 sites and surrounding areas began on March 10, 2003. Fieldwork was directed under TAN Work Order 65093. Coordination with the TAN decontamination and decommissioning (D&D) field team leader in scaling down the D&D construction work area, located within the area to be surveyed, enabled the survey work to proceed without interference. Most of the survey work outside the fenced AOC over the V-Tanks area was completed on March 10, 2003. All field survey work inside the AOC, and the remaining ERA survey work to be completed outside the AOC, was completed on March 11, 2003. Prejob briefings and daily briefings were held before starting work in accordance with Management Control Procedure (MCP) -3003, "Performing Pre-job Briefings and Documenting Feedback." When work required entry into the AOC, personnel also worked under Radiological Work Permit (RWP) No. 3100297100.

Equipment used for performing the magnetic surveys was contained in a portable unit as shown below in Figure 3-2. Sage personnel pushed the equipment back and forth within the grid area on line with the layout survey. Data were stored electronically on the computerized survey system data recorder and subsequently downloaded and analyzed to generate a vertical gradient magnetic field spatial map identifying subsurface anomalies.

Figure 3-2. Magnetic survey equipment.

Electromagnetic surveys were completed in a similar manner using a pull cart to support the detector. Data collection equipment for the TDEMI system was carried in a backpack and connected to the pull cart. The TDEMI equipment was pulled back and forth over the grid area as data were collected and stored. Data were later downloaded and analyzed in a manner similar to that mentioned above, and a Geonic EM-61 spatial map generated identifying subsurface anomalies as above.

The spatial maps developed from the geophysical surveys were overlaid onto an existing drawing developed from as-built facility drawings. These overlays (Figure 3-3 and Figure 3-4) show that subsurface anomalies (piping and tanks) exist in the areas where the drawings identified them as being located. Although the spatial maps are, in themselves, inconclusive, they do indicate the facility drawings are fairly accurate, as many of the geophysical anomalies fall in close proximity to the expected locations. Sage Earth Science provided an interim report (see Appendix A) presenting results of the surveys. These maps show the locations of features in the TSF-09/19, TSF-21, and surrounding areas provided by the INEEL as interpreted from the geophysical data.

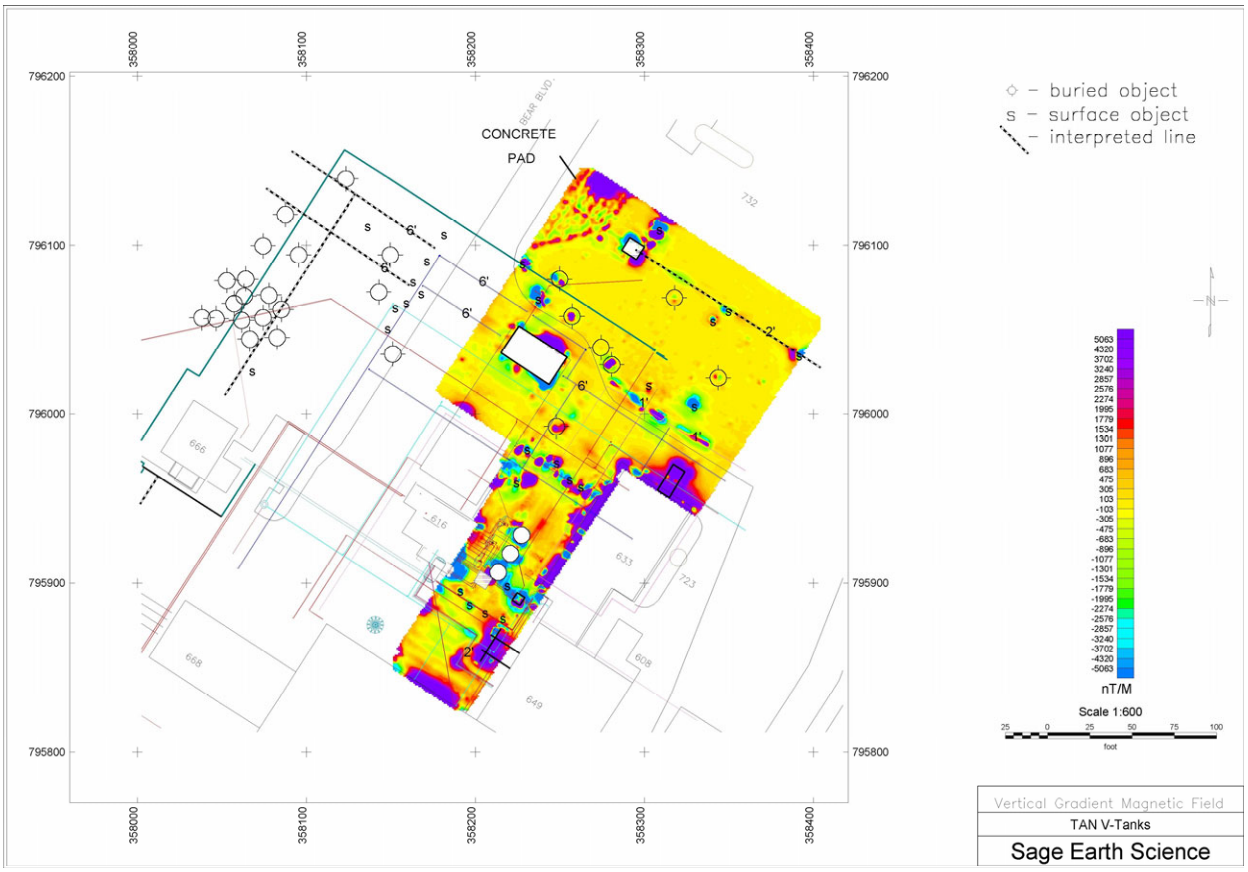

Figure 3-3. Magnetic survey map.

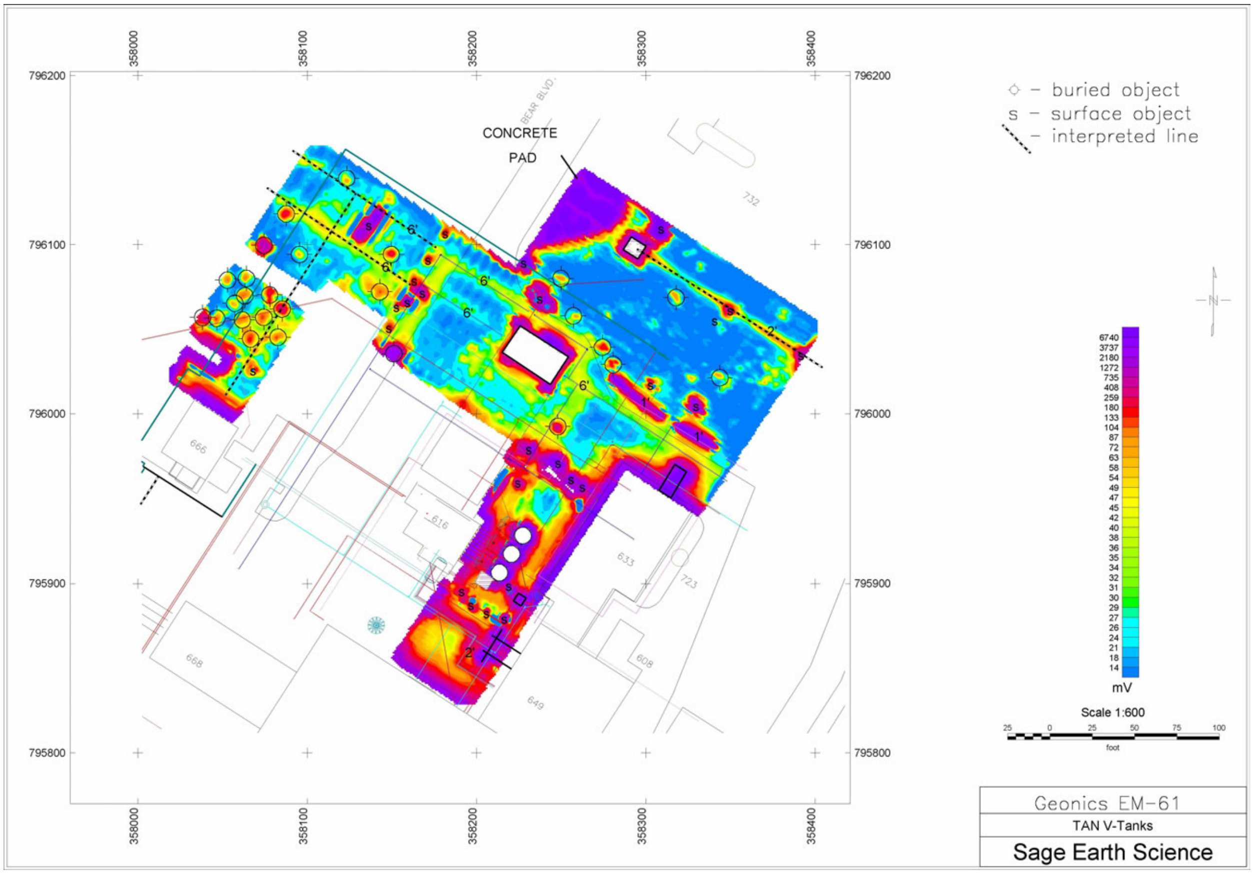

Figure 3-4. Time-domain electromagnetic induction survey map.

3.3 Ground-Penetrating Radar Surveys

A review of previous GPR surveys in the TAN area revealed that data collected in the V-Tank areas would be limited in value for depths greater than 6-ft. Maps were obtained showing the accumulated GPR data in the V-Tanks area. As a final check, all initially defined Phase II sample locations underwent GPR evaluation to verify that no near-surface interference was evident prior to drilling activities. Interference in two of the selected locations was detected, and sample points were moved to prevent contact with identified subsurface anomalies. A more detailed account of this activity is included in Section 5. Spatial representation of the GPR-identified anomalies in the TSF-09/19, TSF-21, and surrounding areas was overlaid onto the drawing used in previous overlays, which were developed from as-built facility drawings. This map is shown in Figure 3-5.

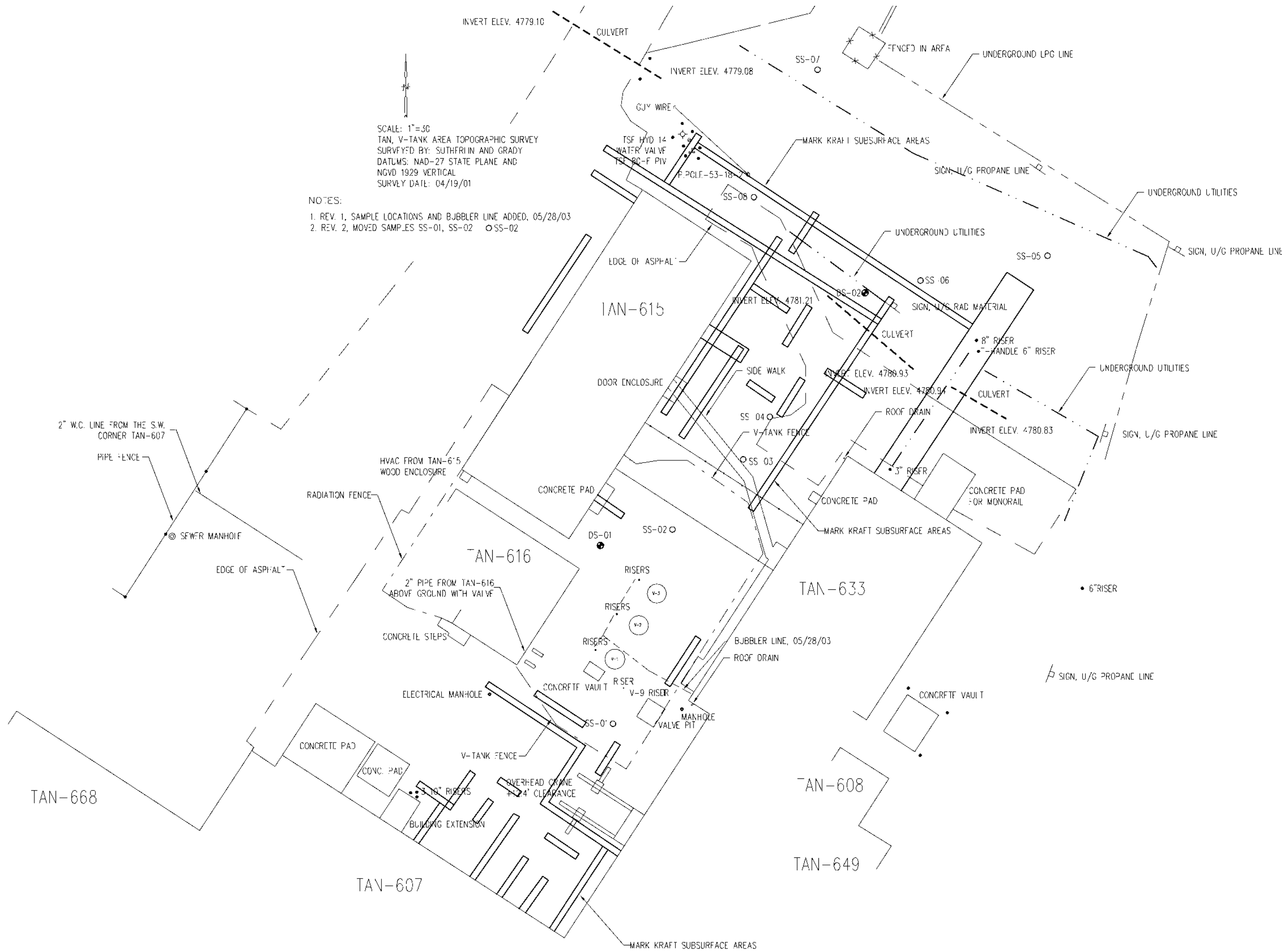

Figure 3-5. Ground-penetrating radar V-Tanks survey map.

4. EARLY REMEDIATION ACTIVITIES PHASE I SAMPLING—SOIL SURFACE IN SITU GAMMA SURVEY PERFORMED AT THE TSF-09/18 AND TSF-21 SITES DURING CALENDAR YEAR 2003

As stated in the project FSP, Phase I of the project sampling effort was a soil surface in situ gamma scan survey in the TSF-09/18 and TSF-21 site areas. This survey was completed to determine actual surface contamination in the area. Survey data were used in selecting sampling locations for Phase II sample collection (drilling).

The survey used the grid initially developed in the site plan layout survey. The 10 × 10-ft and 20 × 20-ft grid spacings were selected so that a collimated gamma spectrometer in a shielded configuration could be set up to limit surface gamma survey fields to either a 12 or 20-ft diameter. This provided more definition over the survey area to delineate a high-resolution activity profile. Detection field diameters selected for specific sample points were based on area operational history. The 10-ft diameter detector configuration was used in and around areas where contaminated spills were previously recorded. This detector configuration also was used in the area where the TSF-21 valve box was previously located. Other areas located primarily on the periphery of potentially high contamination areas utilized the 20-ft diameter detector configuration to minimize the total points requiring survey. Due to very high count rates, some of the measurements taken at locations near the V-9 tanks were performed using a collimated/shielding arrangement with an additional 2-in. thick lead plug added to the detector. Figure 4-1 shows the detector in its normal configuration for collecting data. Figure 4-2 shows the detector with the lead shield installed.

Figure 4-1. Normal detector configuration.

Figure 4-2. Shielded detector configuration.

A total of 190 measurements were taken within the area. The data collected from the survey shows high mean values of Cs-137, Co-60, and K-40. An interoffice memorandum to Jim Jessmore from C. P. Oertel entitled, "WAG 1 OU 1-10 Group 2 Soil Surface In Situ Gamma Scan Results," (see Appendix B) is a presentation of the data and resulting maps. Figure 4-3 is a representation, based on survey data, showing the Cs-137 contamination contour of the area. The data show high levels of Cs-137 in the spill area located near the V-Tanks. Relatively high levels of Cs-137 also are indicated where the TAN-649 pool area access door and overhead crane framework are located.

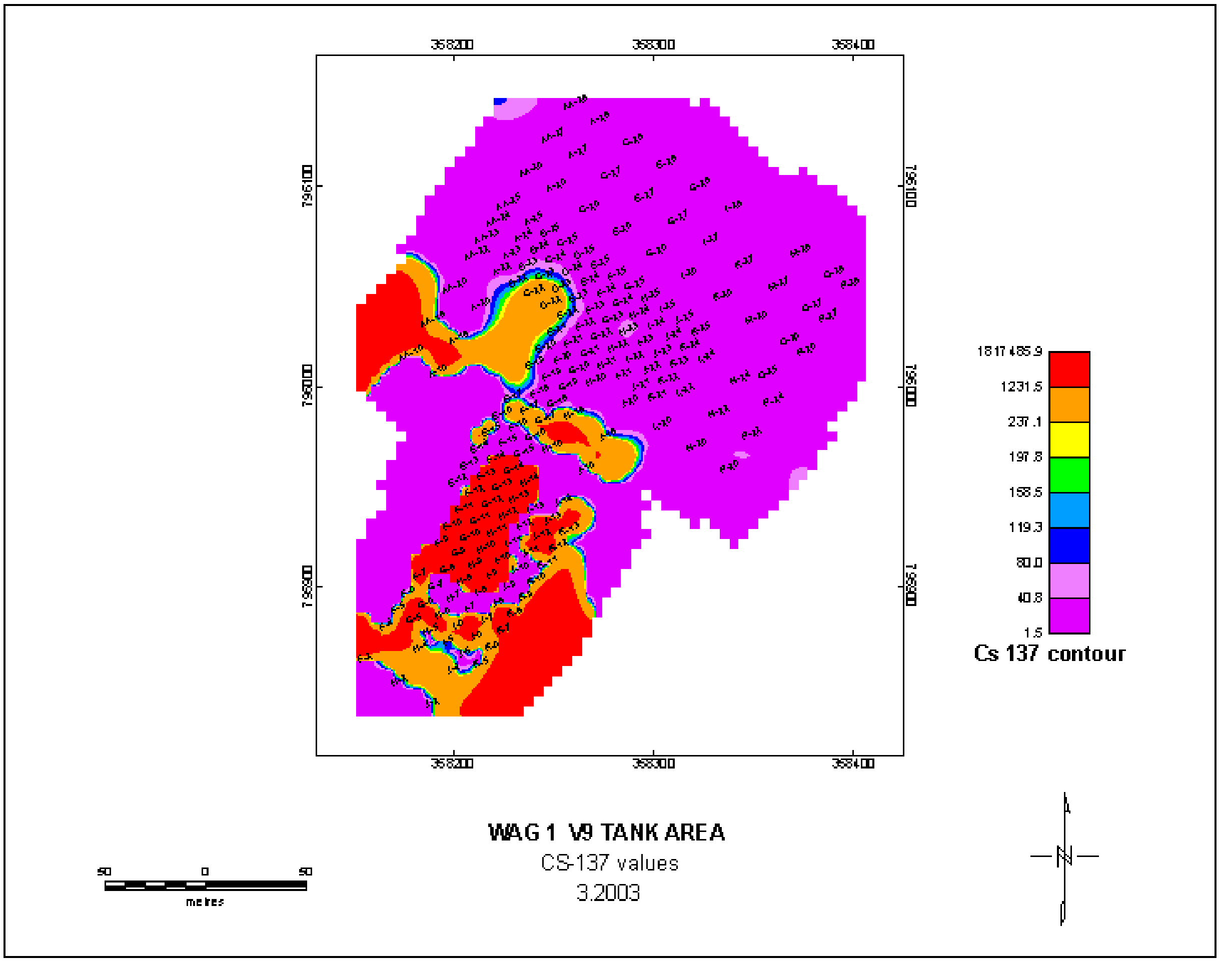

Figure 4-3. Cs-137 contour at Waste Area Group 1, Operable Unit 10-1 soil area (units are pCi/g).

Gamma survey fieldwork started on March 10, 2003, with Technical Procedure (TPR) -6526, “Operating the In Situ Gamma Spectroscopy System,” and Job Safety Analysis (JSA) -611, “Gamma Spectroscopy Using TPR-6526, In Situ Gamma Radiation Measurements,” providing work control. Prejob briefings and daily briefings were held before starting work in accordance with MCP-3003, “Performing Pre-job Briefings and Documenting Feedback.” When work required entry into the AOC, personnel also worked under RWP No. 3100297100. Surface gamma survey fieldwork was completed on March 26, 2003.

5. SAMPLE LOCATION MAPPING AND DEVELOPMENT

Subsurface soil sampling was directed to aid in determination of the extent of contamination that should be encompassed in the CERCLA AOC. Some sample points were biased such that depth or penetration of contamination into soils in known spill areas could be determined. Some points were biased for placement in areas slightly outside the known contamination areas to determine total contamination spread, while others were selected to determine the effects of potential windblown contamination in outlying areas. Gaps in previously collected analytical data for the TSF 09/18 and TSF-21 areas required that some samples be collected at depths down to the underlying basalt. These were collected to determine if contamination exists below the V-Tanks, and to determine if spills from the TSF-21 valve pit were adequately remediated when they were removed.

Eight sample points were selected to address the adequacy of the current AOC determination. These samples would be classified as shallow samples (SS) and would be drilled to a depth of 10 ft. Two points were selected for drilling deep samples (DS) to basalt, or to a depth of 50 ft if basalt was not encountered before reaching 50 ft. Relative locations for these points were identified in the project FSP. The selected locations were incorporated onto the TAN-616 Underground Utilities Partial Site Plan (Figure 5-1) that was developed from as-built drawings of the TSF Intermediate-Level (Radioactive) Waste Disposal System including TSF-09 (V-1, V-2, V-3 tanks), TSF-18 (V-9 tank), and associated piping. The drawing showed that the potential for impacting subsurface piping during drilling activities was probable at some of the proposed sample locations. Shallow sample locations were incorporated into the drawing with sample points labeled as SS-01 through SS-08. Deep sample locations were labeled DS-01 and DS-02.

After making changes to incorporate sample point selection criteria previously identified, and addressing impact areas identified in the drawing, a composite was developed of the TAN-616 Underground Utilities Partial Site Plan (Figure 5-1) with sample points identified. All of the sample points were then field-marked with stakes by the site plan survey team. As a precautionary measure, all of the survey points underwent GPR subsurface investigation to provide the best possible assurance that no subsurface piping would be impacted during drilling activities. The GPR survey revealed that two of the sample points (SS-01 and SS-02) appeared to have subsurface anomalies with the potential for impact during drilling activities. The GPR survey team marked the soil surface with paint (Figure 5-2 and Figure 5-3) to identify impact areas and provided an alternate location for each of the sample points. The sample points were relocated as suggested and re-marked and recorded by the site plan survey team. The drawing (Figure 5-1) was updated to correctly show all sample points.

Logic for placement of the sample locations is identified as follows:

- Placement of sample location SS-01 (Figure 5-2) was intended to be near the TAN-649 pool area bridge crane girder bracing in a relatively high contamination area. After reviewing the TAN-616 Underground Utilities Partial Site Plan it was determined that underground piping shown in the preferred location posed an unacceptable risk of impact during drilling operations. A location in the currently identified AOC with a relatively high amount of surface contamination nearer to the V-9 tank was selected.

- The SS-02 location (Figure 5-3) was chosen because it was in the AOC located slightly plant north of the V-3 tank in a high surface contamination area with no apparent subsurface piping issues. As stated previously, the pre-drilling GPR survey required that the location be moved slightly farther plant north. This was done while still meeting the previously mentioned criteria.

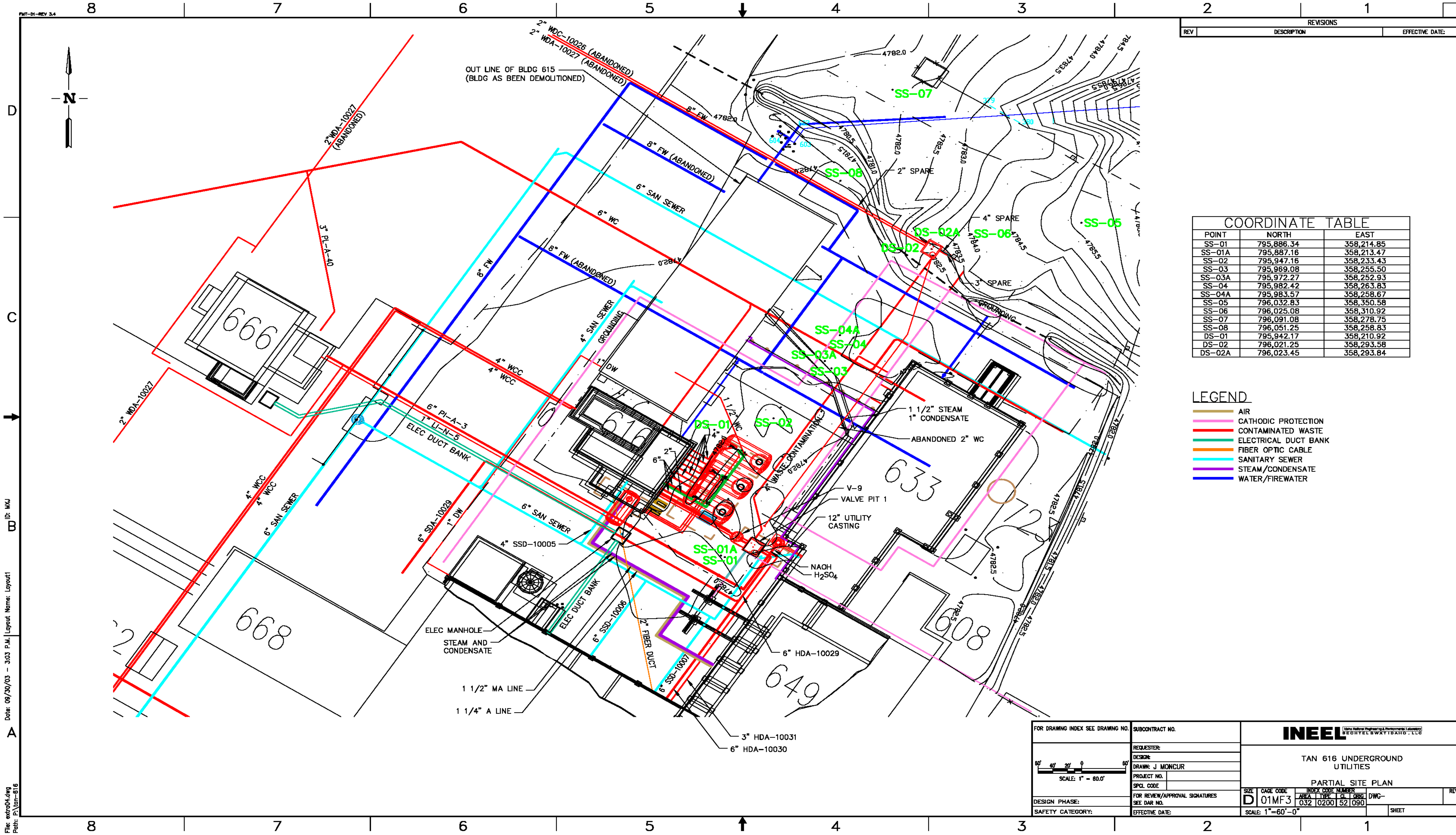

Figure 5-1. TAN-616 Underground Utilities Partial Site Plan.

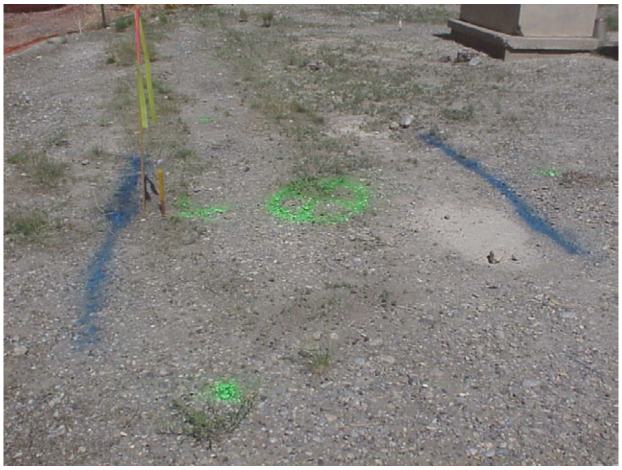

Figure 5-2. SS-01 ground-penetrating radar survey results.

Figure 5-3. SS-02 ground-penetrating radar survey results.

- The SS-03 location (Figure 5-4) was chosen because it is located on the edge of the detected surface contamination area just outside the existing AOC.

- A point just a few feet plant north of SS-03 was chosen for SS-04. SS-04 is located a little farther outside the AOC (Figure 5-5). Samples from these locations were expected to provide indication of whether the AOC should be extended farther north.

- The SS-05 sample location (Figure 5-6) was positioned plant north of TAN-633 to address windblown surface contamination issues that may have originated from the TAN facility or from the TSF-21 valve box contamination.

- The SS-06 sample location (Figure 5-7) was positioned approximately 15 ft plant northeast of the TSF-21 area to determine if contamination issues below surface elevation exist near the removed valve box.

- The sample location for SS-07 (Figure 5-8) was selected to address windblown contamination issues. The location is near the concrete pad provided for the decommissioned Process Experimental Pilot Plant propane vaporizer located north of the V-Tanks area. This varies somewhat from the proposed FSP location that indicated a sample location on or near the larger concrete pad located north of the vaporizer pad. Based on surface contamination data from the surface soil gamma survey, it was decided that the SS-07 location did not need to be so far north to address windblown issues.

- The SS-08 sample location (Figure 5-9) was plant north of the decommissioned TAN-615 facility in a somewhat elevated surface contamination area to determine contamination issues there.

- The DS-01 (Figure 5-10) deep drilling sample location was placed near V-3 tank to determine if any contamination in the area had penetrated to basalt.

- The DS-02 sample location (Figure 5-11) was placed where the TSF-21 valve pit was previously located to determine if any valve pit leakage had penetrated to basalt.

Figure 5-4. SS-03 sample location.

Figure 5-5. SS-04 sample location.

Figure 5-6. SS-05 sample location.

Figure 5-7. SS-06 sample location.

Figure 5-8. SS-07 sample location.

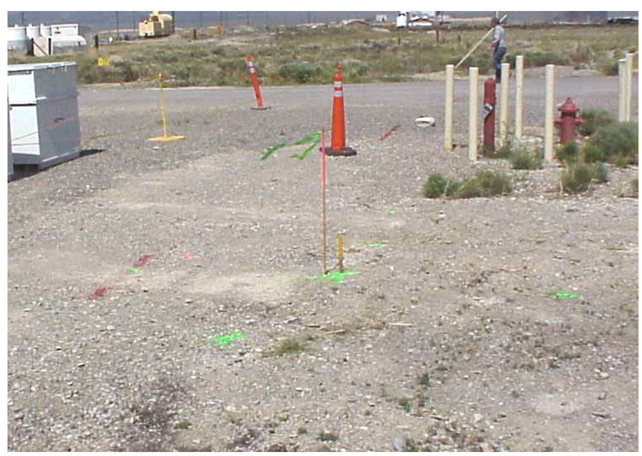

Figure 5-9. SS-08 sample location.

Figure 5-10. DS-01 sample location.

Figure 5-11. DS-02 sample location.

6. EARLY REMEDIATION ACTION CONTAMINATED SOIL PROFILING ACTIVITIES PERFORMED AT THE TSF-09/18 AND TSF-21 SITES DURING CALENDAR YEAR 2003

The CY-03 ERA contaminated soil profiling activities are associated with trying to attach a three-dimensional profile to the resulting soil contamination present in the TSF-09/18 and TSF-21 contaminated soil AOCs. The ERA activity initially looked at the series of surficial contaminated soil evaluations that had previously been performed on the V-Tank AOC to determine the desired locations for boreholes that would be driven into the V-Tank AOC. A description of the borehole drilling activities is presented in Section 6.1 of this report.

Following borehole placement, a vertical logging exercise was performed at various depths within each borehole to determine the radiological profile within each borehole as a function of depth. This vertical logging activity was necessary to define the three-dimensional contamination profiles within the V-Tank AOC to determine if the hypothesis of surficial contamination (i.e., that surface contamination spill decreases in concentration as one moves deeper into the soils) is true. Details of the downhole logging activities are summarized in Section 6.2 of the report.

Finally, a complete sample evaluation was taken on select borehole areas to determine if Cs-137 could be used as the lone target in defining whether a residual risk is still present in residual soil surfaces following excavation. Core samples of the select boreholes were submitted to a complete suite of compositional analyses (radiological, inorganic, volatile organic, semivolatile organic, and PCB). The resulting inorganic/organic data were then evaluated against the specified residual risk criteria associated with each COPC to determine if those samples with inorganic or organic (or PCB) residual risks above 1×10^{-4} are only located in samples where the Cs-137 concentrations are also above the FRG criteria of 23.3 pCi/g (i.e., the FRG for Cs-137 that would allow for a residual risk of 1×10^{-4} after 100 years of decay). Details associated with the sample composition evaluation are summarized in Section 6.3 of this report.

6.1 Borehole Drilling Activities

Statement of Work-910, "Coring and Sampling Near the V-Tanks at Test Area North at the INEEL," was developed to address the sample drilling scope in support of scheduled WAG 1, OU 1-10 project objectives. The ERA scope of work identified in the SOW was to:

- Mobilize and demobilize equipment at the job site, including equipment delivery to and from the job site, equipment setup, decontamination, and disassembly.

- Core 10 boreholes (two boreholes from land surface to the top of the first basalt, and eight boreholes from land surface to 10 ft in depth) using a hollow-stem, continuous wire line core rig. To avoid cross contamination and preserve volatile organics, Lexan liners were used for locations sampled for offsite analysis. Boreholes used for onsite radiological analysis required 4-in. carbon steel pipe casing placement in the boreholes.

- Backfill boreholes with unused core material, sample residuals, or makeup material (as necessary) after core samples were collected and radiological sampling was completed.

The contract for drilling activities was issued to Dynatec Drilling Services, Inc. of Salt Lake City, Utah. The drilling and soil sampling activities supported by Dynatec were completed using two different drilling configurations (Figure 6-1). One configuration consisted of a larger drill rig using 6-in. auger flights (DS-24) with the capability of collecting Lexan-encased core samples to provide soil samples for obtaining analytical data specific to environmental contaminants down to the 50-ft depth specified in the contract. The 30-in. long Lexan cores contained sample material that was collected in 2-ft increments during drilling. Sample recovery varied from 0 to 100% in these cores. The other drilling configuration utilized a smaller drill rig with 8-in. augers to drill the shallow (10-ft) boreholes that were used for collection of vertical radiological contaminant profiling data. No sample cores were obtained from this drilling configuration. A 10-ft long, 4-in. diameter carbon steel pipe (Figure 6-2) was placed in these boreholes, and the auger flights were removed to allow boring multiple boreholes with a minimum number of auger flights.

Figure 6-1. Early remediation activities drilling rigs.

Figure 6-2. The 4-in. well casing.

A project management self-assessment to start drilling and sampling work in the TAN WAG-1 TSF-9 and TSF-18 (V-Tank area) was conducted June 30, 2003. An interoffice memorandum[a] dated July 1, 2003, was sent to the facility manager, Kevin Streeper, from the project field team leader, P. A. Sloan, addressing completion of management self-assessment prestart items required for startup. The memorandum also requested approval to start the drilling and sampling activities. Approval from the facility manager and concurrence from the department manager, Robert Miklos, was received by project personnel via an interoffice memorandum[b] dated July 1, 2003, from Kevin Streeper to Robert Miklos. Drilling activities began the afternoon of July 1, 2003. Work control for the activities was provided by a TAN work order and several task-specific JSA documents. Work Order 65034 was signed in with the TAN shift supervisor each day that work occurred, followed by a prejob briefing that was attended by all working personnel before work began. The JSAs used, as applicable, in support of the work are listed as follows:

- JSA # 001, "Augering and Sampling," provided by the vendor (Dynatec), to support drill rig operation and core sample collection

- JSA # NW-001, "Sampling–Manual Hand Augering and Logbook Keeping," to support the activity geologist in work associated with drilling and sampling activities

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a. Sloan, P. A. to K. E. Streeper, 2003, "Pre-Start Items Completion for Start of V-Tank Area Early Remedial Action Sampling Activity Management Self-Assessment," July 1, 2003.

b. Streeper, K. E. to R. P. Miklos, July 1, 2003, "Management Self-Assessment for Start of V-Tank Area Early Remedial Action Sampling Activity," Letter File No. KES-04-03.

- JSA # TAN-JSA-788, “Sampling–Scoops/Scrapers/Knives/Snips,” to provide support for Bechtel BWXT Idaho, LLC (BBWI) personnel in work associated with sampling activities

- JSA # TAN-JSA-786, “Sampling–Manual Hand Augering,” to provide support for BBWI personnel in work associated with sampling and manual hand-augering activities.

After receiving approval to start work, shallow wells were drilled and casings installed on July 1, 2003, at the SS-07 and SS-05 locations using the smaller drilling rig. No problems were noted, nor was any radiological contamination found at either of these locations.

On July 2, 2003, both the large and small drill rigs were placed in service. The small rig was placed over the SS-06 location and the large rig was placed over the DS-02 drilling location. Radiological contamination in drill cuttings was noted at the SS-06 location at approximately 3 ft in depth. Radiological contamination also was noted in the DS-02 cuttings at approximately 8 ft in depth. Radiological Control technicians established a radiological control area around both drill sites and placed the drilling crews in appropriate personal protective equipment (Figure 6-3 and Figure 6-4). Boring at the SS-06 location was completed and the drill rig moved to the SS-04 location.

Figure 6-3. Drilling DS-02.

Figure 6-4. Drilling SS-06.

It was noted that no sample material was recovered while drilling and coring in the DS-02 location from the 0 to 2 ft core. Drilling continued through the 2 to 4-ft depth with no recovery. The drillers installed a catcher on the coring auger and commenced drilling through the 4 to 6-ft depth with still no recovery. The drilling crew then lengthened the auger drilling shoe and continued drilling through the 6 to 8-ft depth and achieved 50% recovery. Drilling at further depths continued to achieve adequate sample recovery through the full depth of the hole. On Monday, July 7, 2003, the drilling crew reached basalt at a depth of 47 ft 9-in. The drill bit was removed and the auger flights were left in place to allow downhole logging of the bored hole. A tape was dropped into the hole and depth was measured at 46 ft 6 in. (It is postulated that some sluffing occurred when the drill bit was removed). Auger flights were left in place and downhole gamma logging of the hole was completed on July 8, 2003. On July 9, 2003, auger flights were then pulled from the hole and the rig was moved approximately 2 ft to the north. Coring to a depth of 8 ft was then completed in the new location to obtain sample material from this depth range within the removed Valve Box 2 location. Physical characteristics of the soil throughout the depth of the boreholes in this area are as follows:

- No soil recovery was obtained from the 0 to 2-ft depth.

- Soil from the 2 to 8-ft depth consisted of gravels and silts with medium, pebble-sized grains.

- Soil from the 8 to 10-ft depth consisted of a clay layer.

- Soil from the 10 to 24-ft depth consisted of silty clay with slight moisture appearing at the 24-ft depth.

- Soil from the 24 to 30-ft depth consisted of moist, silty sand with a void located between 27 and 28 ft.

- Soil from the 30 to 44-ft depth consisted of a dense and compacted, slightly moist silt and clay mixture with reddish-brown ferrous material intermixed with the clay.

- Soil from the 44 to 46-ft depth consisted of a dense clay mixed with some sand.

- Soil from the 46 to 47 ft 9-in. depth consisted of a moist silt and clay mixture. Basalt at the bottom of the borehole was vesicular and light gray to brown in color.

At the SS-04 location, the drilling crew noted refusal at approximately 4 ft in depth. Drilling was stopped and the auger inspected. A small piece of slightly magnetic metal was found on one tooth of the auger bit (Figure 6-5). The hole was then manually excavated to the 4-ft depth and a pipe approximately 1-1/4 in. in diameter was discovered running in a north-south orientation through the west side of the hole. No apparent damage was done to the pipe other than shaving the small chip from the pipe surface. No radiological contamination was noted in the hole.

Figure 6-5. Metal chip.

Facility drawings were reviewed by the project field team leader, project manager, and the facility manager. It was decided to move the sample location approximately 5 ft to the west. SS-04 was then drilled to depth with no further complications. It was determined that the subsurface anomaly would possibly impact the SS-03 sample location due to its orientation; therefore, the SS-03 location also was moved approximately 5 ft to the west. This location was hand-augered to the 4.5-ft depth before moving the drill rig over the new location. SS-03 was drilled to depth with no further complications. The SS-06, SS-04, and SS-03 borings were completed on July 2, 2003.

The small drill rig was then positioned over the SS-08 sample/drilling location. No problems were encountered in drilling and the hole was completed with casing set on July 7, 2003. A safe work permit (SWP) was generated to support drilling within 5 ft of known subsurface obstructions before drilling the SS-01 sample location. The SWP required that a small hand auger be used to penetrate the sample location and probe for obstructions to a depth of 10 ft. A hole was bored with the hand auger to the 10-ft depth at the SS-01 location; no obstructions were encountered. The small drill rig was then moved and positioned over the sample location and drilling commenced. Drill cuttings from the hole were contaminated at 4,000 disintegrations per minute (DPM) at the 7-ft depth. When the auger was removed, it had a maximum contamination reading of 15.5 K DPM. It was decided to continue drilling the SS-01 sample bore to the 20-ft depth due to the high levels of contamination found at the 10-ft depth. The small drill rig was removed from the SS-01 sample location and replaced with the large drill rig to achieve the required depth.

Drilling activities were suspended July 8, 2003, due to high winds. The large drill rig was moved into place over the SS-01 sample location on July 9, 2003. Drill cuttings from the hole read 25-30 K DPM at the 13 to 14-ft depth. Readings on cuttings taken from the 15 to 16-ft depth read 1K DPM. Cuttings at deeper depths dropped off to 0 DPM at approximately 18 ft. The sample boring was completed and its 20-ft casing installed on July 10, 2003.

The small drill rig was removed from the SS-01 sample location on July 9, 2003, and was moved to the SS-02 sample location after it was hand-augered, per the SWP, to check for subsurface obstructions. The hole was drilled and completed with no problems encountered.

The large drill rig was set up over the DS-01 sample location after it was hand-augered to a depth of 10 ft, per the SWP, to check for subsurface obstructions on July 10, 2003. Adequate sample recovery was obtained from all cores. The only radioactive contamination noted during drilling was at the 2 to 4-ft depths. The hole was completed and basalt was encountered at just over the 40-ft depth. Physical characteristics of the soil throughout the depth of the boreholes in this area are as follows:

- Soil from the 0 to 4-ft depth was medium-grained sand to pebble-sized gravel with low moisture
- Soil from the 4 to 8-ft depth range consisted of slightly moist silt, sand, and pebble-sized round gravel
- Soil from the 8 to 10-ft depth consisted of slightly moist silt and medium-grained sand
- Soil from the 10 to 20-ft depth consisted of slightly moist silt and clay with occasional round pebbles
- Soil from the 20 to 30-ft depth consisted of slightly moist, silty, medium-grained sand with clay
- Soil from the 30 to 32-ft depth consisted of slightly moist silt and clay
- Soil from the 32 to 36-ft depth consisted of slightly moist silt and clay with iron oxide blotches
- Soil from the 36 to 38-ft depth consisted mostly of moist clay
- Soil from the 38 to 40-ft depth consisted of slightly moist silt and clay with iron oxide blotches
- Basalt was encountered at slightly deeper than 40 ft.

All soils excavated from the borings located within the fenced AOC were placed back in the AOC. Contaminated soils from the SS-06 and DS-02 borings were placed back into their respective holes to the extent possible. Soil not able to be placed back in the excavations was placed in small bags in the location of the holes and covered with clean soil to clear the area for normal access and to remove the contamination barrier set up during drilling activities.

6.2 Downhole Logging Activities

Vertical profiling of the radiological contaminants in soil in the AOC was accomplished by collecting radiological data from the ten sample borings. Logging was completed using the INEEL Gamma Spectroscopy Logging System (GSLS). The GSLS consists of hardware and software designed to locate, identify, and quantify near-surface and subsurface radionuclide data in boreholes and monitoring wells. The system is composed of logging tools (detector[s] and housing), nuclear pulse processing equipment, hydraulic winch, and computer control equipment. The equipment is mounted in a four-wheel drive van (Figure 6-6).

Figure 6-6. Gamma logging van.

The logging tool used to support the vertical profiling at TAN was comprised of an 18% relative efficiency high-purity germanium (HPGe) detector, high voltage power supply, and pre-amplifier. This equipment, along with a liquid nitrogen dewar, is contained in a water-tight casing. The tool has a diameter of 3.65 in. and can be used in any well or borehole with an inside diameter (i.d.) of 4 in. or larger. A partial listing of radionuclides identified with this system is: K-40, Co-60, Sb-125, Cs-137, Eu-152, Eu-154, Ti-208 (Th-232 daughter), Pb-214, Bi-214, Ra-226, Pa-234m (U-238 daughter), U-235, and U-238. Concentrations are typically reported in pCi/g, with 1-sigma counting uncertainty.

The vertical profiling task in and around the TAN V-Tanks included well logging of 10 boreholes; eight shallow boreholes ≤ 20 ft deep, and two boreholes drilled to the basalt interface, which occurred at depths of less than 50 ft. Typical data collection procedures included setup of the GSLS over the borehole, lowering the detector to the bottom of the borehole, and sequential stationary measurements at 1-ft increments throughout the depth of each borehole from the bottom to land surface. Count times ranged from 200 to 1,000 live-time seconds.

The shallow boreholes were augered to depth using 10-in. augers. The drill head was disconnected from the auger, and 4-in. Schedule 40 carbon steel casing was lowered to the bottom of the hole, the drill head reconnected, and the auger flights removed. Logging was completed through the 4-in. casing. The shallow boreholes were to be augered to 10 ft unless contamination was encountered at the 10-ft depth, then the hole was augered an additional 10 ft to a total depth of 20 ft. The deep boreholes were augered to depth using 6-in. augers. The auger flights were left in place, and the logging was completed through the augers. The deep boreholes were to be augered to a depth of 50 ft below land surface, or to the soil basalt interface, whichever was less. Table 6-1 lists the boreholes and the total depth logged in each borehole. The logged depths in each of the boreholes are less than the total depths because the centerline of the HPGe detector is approximately 6 in. above the bottom of the logging tool.

Table 6-1. Borehole depth.

Borehole ID	Logged Depth (ft)
SS-01	19.0
SS-02	9.5
SS-03	9.5
SS-04	9.5
SS-05	9.5
SS-06	9.25
SS-07	9.5
SS-08	9.5
DS-01	38.0
DS-02	43.5

Data collected for each borehole was displayed on graphs with Cs-137 shown as the major contaminant of concern (COC). Figure 6-7 is a typical data plot of the borehole data. Appendix C contains the complete report for the TSF-09/18 and TSF-21 sites WAG 1, OU 1-10 V-Tank area soils vertical profiling activity.

The logging van was moved to the TAN AOC on July 2, 2003, to review operating procedures, complete required training, and to check the logging system. The system requires cooling with liquid nitrogen prior to logging activities; therefore, logging was not started until July 7, 2003. Work control for logging activities consisted of JSA-823, “Subsurface Gamma-Ray Logging Using the Gamma Spectroscopy Logging System,” and TPR-77, “Gamma Spectroscopy Logging System.” Prejob briefings were conducted each day work was performed, as per MCP-3003, “Performing Pre-job Briefings and Documenting Feedback.”

On July 7, 2003, the logging van was set up over the SS-06 and SS-08 boreholes and data was collected. The van was moved to the DS-02 borehole on the morning of July 8, 2003. Data collection was completed on DS-02 at 1715 in the evening. On July 9, 2003, data was collected from boreholes SS-05, SS-07, and SS-04. Borehole SS-03 was counted on the morning of July 10, 2003, and SS-01 was started in the afternoon. The logging van had to be taken back to Central Facilities Area late in the afternoon to replenish it with liquid nitrogen. The logging van returned on July 14, 2003, and SS-01 counting was completed in the morning. The logging van was then positioned over DS-01 and counting began. Counting of the DS-01 borehole continued on July 15, 2003. It was discovered that approximately 25% of the data from the DS-01 borehole was lost. Counting continued on July 16, 2003, to complete the data. The logging van was moved to borehole SS-02 and data collection was completed.

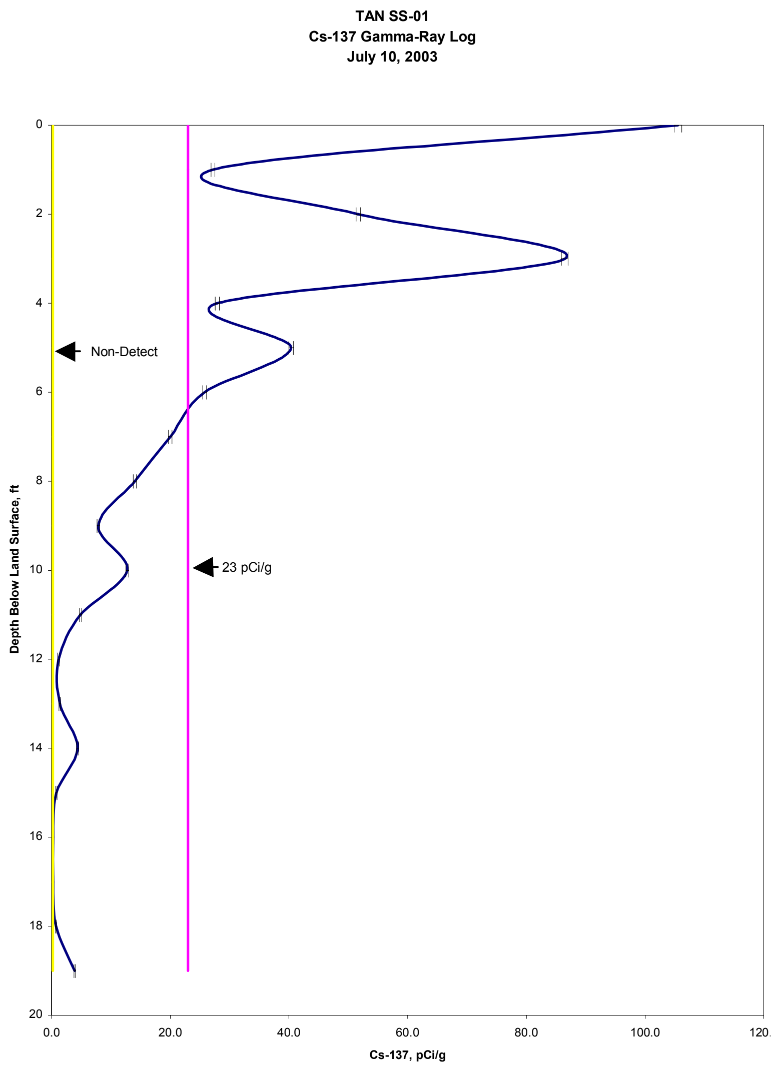

Figure 6-7. SS-01 Cs-137 gamma log.

Section 8 provides a summary of data interpretation for the work completed in this logging activity. General findings indicated that Cs-137 contamination above acceptable levels was found in the Valve Pit 2 area (identified as DS-02 in Figure 5-1) to approximately 10 ft in depth. The sampling location (identified as SS-06) adjacent to DS-02, where the excavated soil was placed during Valve Pit 2 excavation, showed Cs-137 contamination to approximately 6 ft with the highest contamination levels at approximately 2 ft in depth. Unacceptable contamination levels also were found near the Valve Pit 1 area (identified as SS-01) to a depth of approximately 6 ft. The remainder of the borehole data suggests that some Cs-137 contamination is located near the surface grade level with minimal penetration into the soil.

6.3 Select Sample Composition Evaluation

As stated above, soil sample material was collected in Lexan liners during drilling activities. As soon as the liners were removed from the auger tool, plastic slip caps were installed and taped on both ends of the liners. The liners were labeled with the date, sample location, and depth, and then placed in coolers where they were cooled to < 4°C. In some cases it was not possible to immediately place the capped and labeled liners in coolers. In these instances, the liners were placed in a cooled vehicle (air-conditioned and running at maximum cooling) until they could be placed in appropriate cooling appliances. Samples were delayed from placement in appropriate coolers a maximum of one hour.

Sample material was collected from the DS-01, DS-02 boreholes, and the SS-01 20-ft borehole. According to the FSP, samples were selected from discrete depths in each borehole relative to the Cs-137 activity detected during downhole logging. The action level determined as the break point for sample collection was 23.3 pCi/g.[c] After evaluation of the vertical profile data obtained from the boreholes, it was discovered that borehole DS-01 activity levels were all below the established break point value. It was decided that analysis of soils from DS-01 would be of minimal value and that these samples would not be processed for analysis. The sample material from DS-01 was placed back into the AOC.

The vertical profile data from borehole SS-01 (Figure 6-7) indicated activity levels greater than the break point value in the 0 to 6-ft depth range with maximum activity in the 3-ft area. Samples designated in the FSP as Waste Management (WM) were taken from this area. Volatile and semivolatile WM samples were taken from the 2.5 to 3.5-ft area of the sample tube. Rather than disturb the samples, a 7-in.-long section of the Lexan tube was cut out to send for analysis. The tube section was capped, taped, labeled, and kept cool. Composite WM samples were taken from the remainder of the soil contained in the 0 to 6-ft sections of Lexan tubing. Composite samples designated as Remedial Action (RA) were taken from the 6 to 10-ft Lexan sections. Volatile and semivolatile samples were handled as mentioned above.

The vertical profile data from borehole DS-02 (Figure 6-8) indicated activity levels greater than the break point value in the 0 to 12-ft depth range with maximum activity in the 7-ft area. Samples designated in the FSP as WM were taken from this area. Volatile and semivolatile WM samples were taken from the 7-ft area in a section of the Lexan tube as described above. Composite WM samples were taken from the remainder of the soil contained in the 0 to 6-ft sections of Lexan tubing. Composite samples designated as RA were taken from the 12 to 16-ft Lexan sections. Volatile and semivolatile samples were handled as mentioned above.

c. A concentration of 23.3 pCi/g for Cs-137 is the remediation goal for soil remediation in the V-Tank area of contamination.

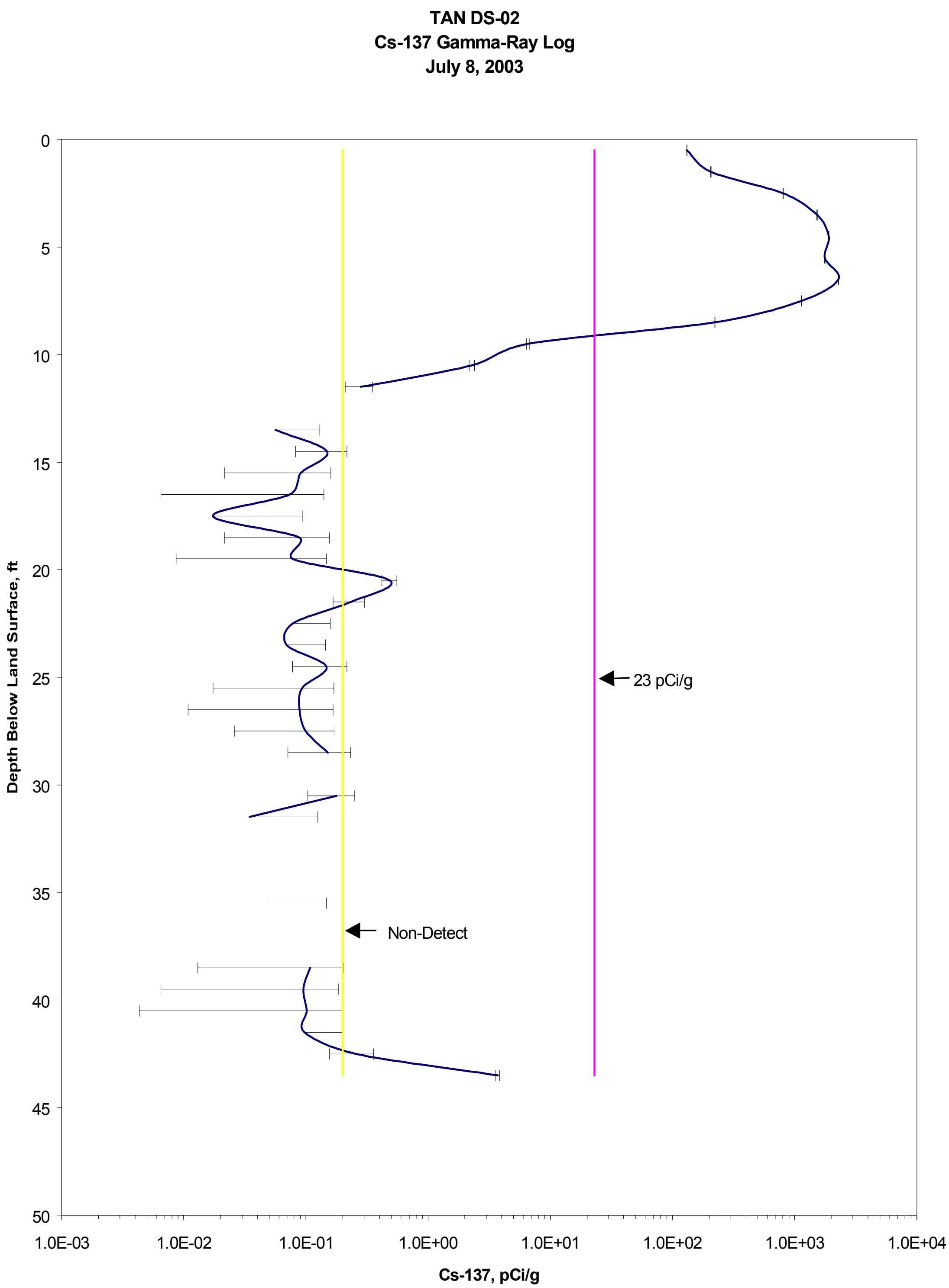

Figure 6-8. DS-02 Cs-137 gamma log.

7. TSF-09/18 AND TSF-21 SITES HISTORICAL SAMPLING DATA

Soil data needed for developing dig maps, performing risk assessments, and developing waste profiles are from the following sources:

- TSF-09/18 historical data (1983, 1988, 1993, and 1998) (see Appendix D)
- TSF-21 historical data (1993, 1996, and 1997) (see Appendix E)
- V-Tank soil sampling in FY-03 (see Appendix F)
- Current (ongoing) D&D sampling around piping and valve pits (see Appendix G).

A discussion of each of these data sources will be presented in this section.

7.1 TSF-09/18 Historical Soil Data

Soil sampling campaigns that targeted the immediate vicinity of the V-Tanks occurred in the following years: 1983, 1988, 1993 Track 2, and 1998. Brief descriptions are provided for each of these sampling efforts.

In 1983, sampling for gamma emitters was conducted as part of a D&D project (INEL 1994). Sampling locations for the 1983 event are shown in Figure 7-1. Six sample locations were chosen to provide a spectrum of contamination levels. These sample locations were comprised of three high-surface radiation levels (grid squares 22, 38, and 37) and three low-surface radiation levels (grid squares 15, 24, and 34). The samples were taken from trenches dug to 1.5 m (5 ft) long × 0.9 m (3 ft) wide × 0.9 m (3 ft) deep. Samples were collected at 6-in. intervals, starting at the surface and going to a depth of 3 ft. A composite of three samples was collected at each interval: one from each side and one from the middle. The samples were then analyzed at the Test Reactor Area radiological measurements laboratory for gamma emitters. Survey results of both the surface samples and the trench samples are presented in Tables H-34 and H-35 of Appendix H of the *Comprehensive Remedial Design/Remedial Action Work Plan for the Test Area North, Waste Area Group 1, Operable Unit 1-10, Group 2 Sites* (DOE-ID 2002).

In 1988, soil samples were also collected from three locations within the V-Tanks area (see Figure 7-2). The purpose of this sampling was to provide additional site-specific data as a part of the DOE Environmental Survey. The soil samples were collected with split barrel samplers and did not go beyond a depth of 2 ft. Two of the borings were located west of the V-Tanks, and the other was located north of the V-Tanks (INEL 1994). While the results of the 1988 DOE Environmental Survey were unpublished, they were reviewed to evaluate the TSF-09/18 area. The sampling results of the soil borings indicated that soil surrounding the V-Tanks showed elevated levels of beta/gamma activity (>.5 mR/hr) and also showed that there were no VOCs or SVOCs present above detection levels (INEL 1994).

The 1993 Track 2 investigation included the collection of eight samples from three boreholes known as Locations A, B, and C (see Figure 7-3). Location A was south of the valve pit next to TSF-18; Location B was off the southwest corner of Tank V-2; and Location C was in the drainage ditch north of Tank V-3. The soil at Location A was sampled at the surface from 0 to 0.5 ft deep, the shallow subsurface

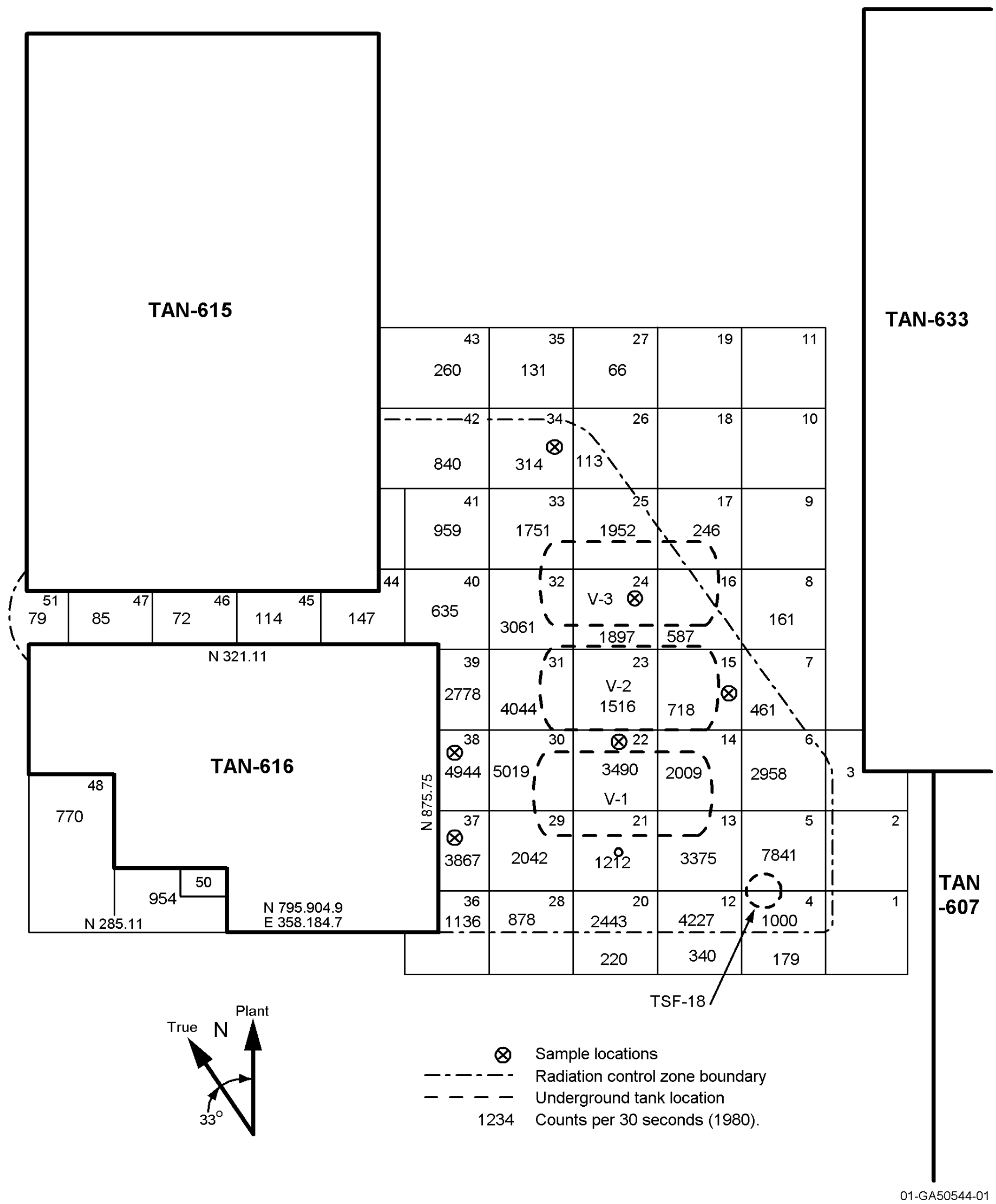

Figure 7-1. Sample locations from soil sampling in 1983.

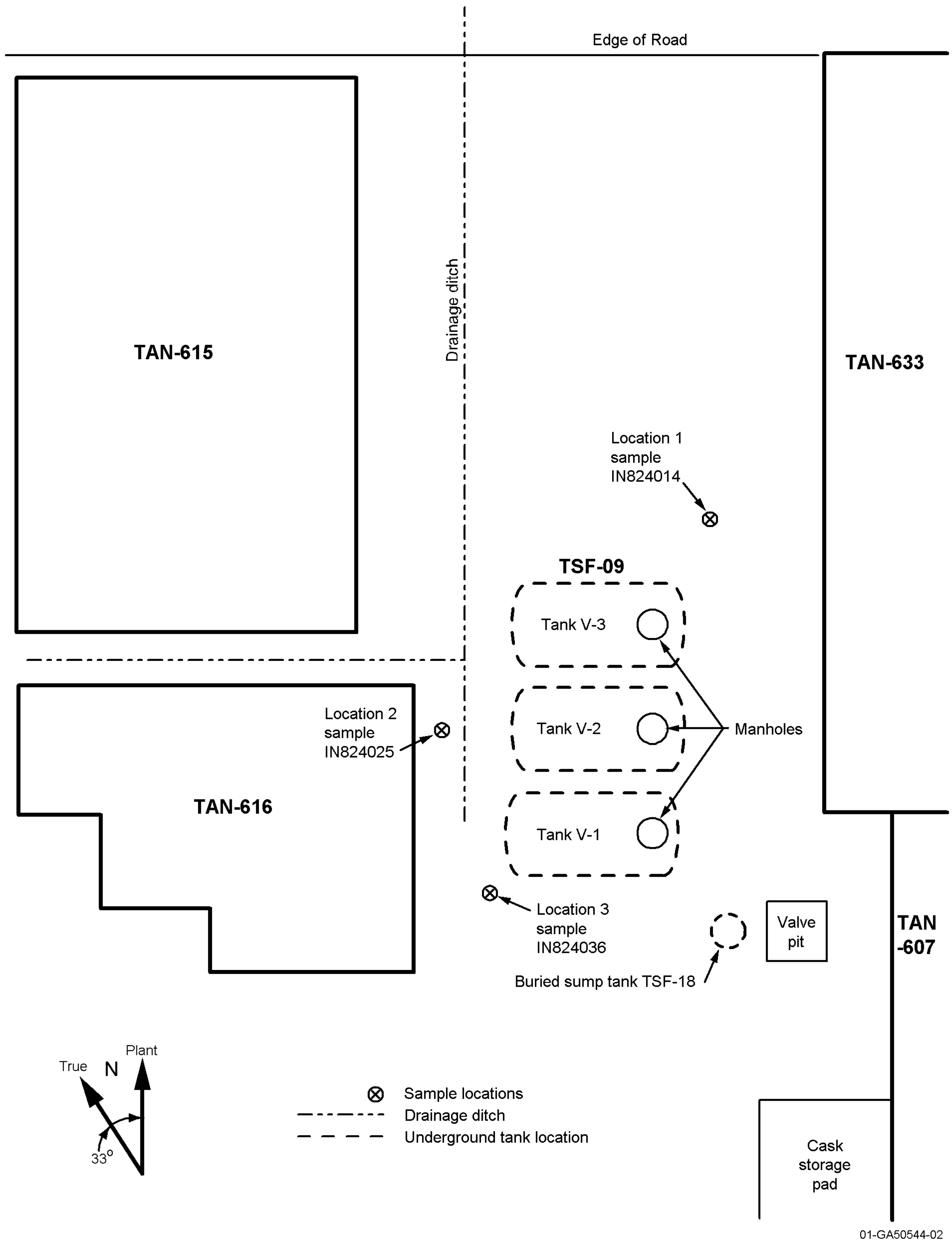

Figure 7-2. Sample locations from soil sampling in 1988.

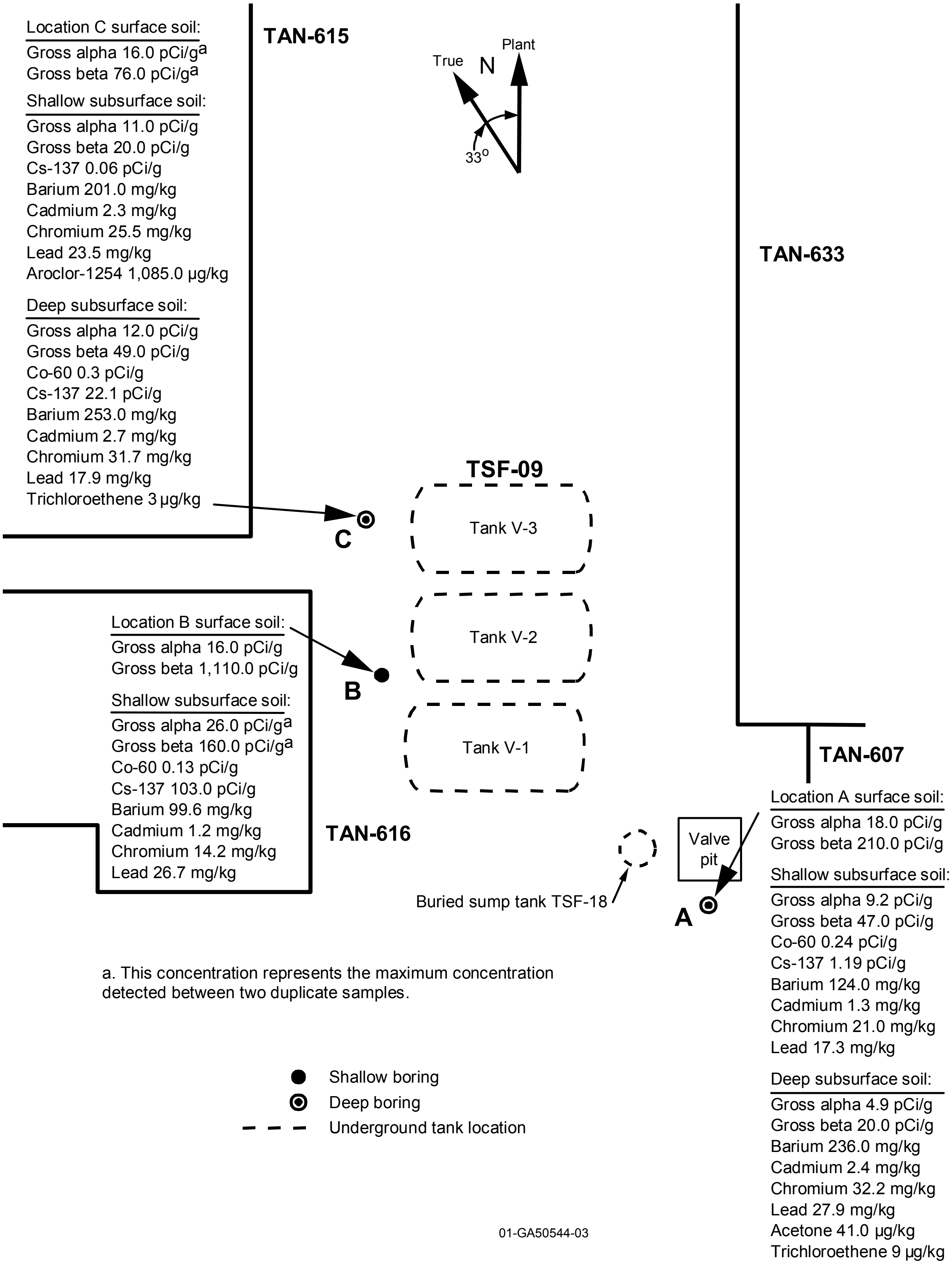

Figure 7-3. Sample locations and results from soil sampling in 1993.

from 0 to 4 ft deep, and the deep subsurface from 20 to 24 ft deep. The soil at Location B was sampled at the surface from 0 to 0.5 ft deep and the shallow subsurface from 5 to 8 ft deep. The soil at Location C was sampled at the surface from 0 to 0.5 ft deep, the shallow subsurface from 0 to 4.5 ft deep, and the deep subsurface from 18 to 22 ft deep. Results of the 1993 Track 2 investigation show that surface soil contamination ranged from 16 to 18 pCi/g gross alpha and 76 to 1,100 pCi/g gross beta. Subsurface measurements of gross alpha ranged from 9.2 to 26.0 pCi/g and gross beta ranged from 47 to 160 pCi/g. Cobalt-60 and Cs-137 were detected in the subsurface with maximum concentrations of 0.3 pCi/g and 103 pCi/g, respectively. The results of the inorganic analyses of samples from various intervals in the boreholes did not indicate elevated concentrations of metals at any of the depth locations. Analyses of VOCs and SVOCs show very low concentrations of three detected organics: acetone, trichloroethene, and Aroclor-1254.

In 1998, the soils surrounding the tanks were resampled. The *Field Sampling Plan for Test Area North TSF-09, TSF-18, and TSF-26 Area Soils* (DOE-ID 1998) was prepared to direct the collection and analysis of soil samples from various WAG 1 sites, including TSF-09 and TSF-18 (see Figure 7-4 for sampling locations). The objectives of the soil sampling included:

- Provide specific VOC data for COCs to be used as the basis to support a no-longer-contained-in determination

- Provide specific PCB data for identified COCs to be used to further support as-found concentrations of PCBs in soil

- Provide specific TCLP metals data to be used to support the statement that the soils do not contain TCLP metals at levels regulated under Resource Conservation and Recovery Act (RCRA).

Four borehole locations were randomly selected from 10 × 10-ft grids. Three samples from discrete depth intervals were collected from each borehole. Shallow surface samples were collected at depths of 1–3 ft, 5–7 ft, and 8–10 ft. Subsurface samples were collected at depths of 10–12 ft, 14–16 ft, and 18–20 ft. Analysis of the soil samples' TCLP VOCs showed nondetect for all analytes. Polychlorinated biphenyls analyses also showed nondetect for all samples. TCLP metal analyses were qualified either as nondetect or estimated. All values are below the RCRA-regulated TCLP and land disposal restriction concentrations. A letter from the DOE (Hain 1998) dated November 3, 1998, in reference to the surface soil sampling, stated that the WAG 1 tanks site TCLP VOCs, TCLP metals, and PCBs were nondetect.

7.2 TSF-21 Historical Soil Data

In three separate events (1993, 1996, and 1997), the soil around Valve Pit #2 (TSF-21) was sampled. Brief descriptions are provided for each of these sampling efforts.

In 1993, three verification soil samples were collected in July from the soil directly beneath the valve pit and along the north-south axis of the pit. In late December, two soil borings were completed to determine the extent and concentration of the potential soil contamination; one boring was in the center of TSF-21, and the other was 15 ft to the west of TSF-21. Sample results for these five samples were presented in the *Preliminary Scoping Track 2 Summary Report for the Test Area North Operable Unit 1-05: Radioactive Contamination Sites* (INEL 1994). During September to November of 1993, soil was excavated from TSF-21 and placed into four boxes (4 × 4 × 8 ft each).

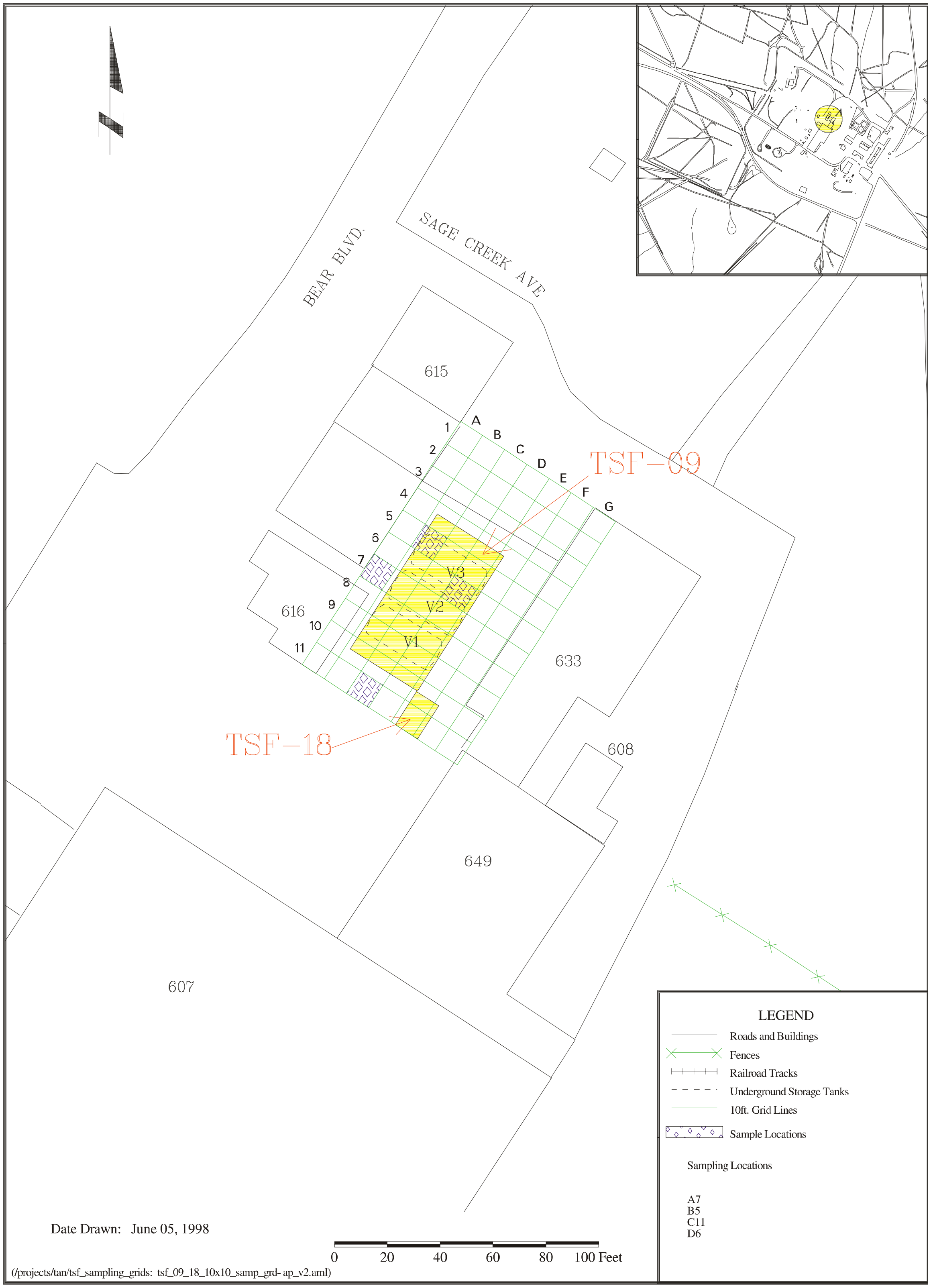

Figure 7-4. Sampling locations from soil sampling in 1998.

In 1996, a single sample was removed from one of the boxes collected in 1993 and analyzed for PCBs, TCLP volatiles, TCLP metals, and gamma spectroscopy.

In 1997, additional samples were collected from all four boxes. One composite sample (for TCLP metals, PCBs, and radionuclide analyses) and three grab samples (for VOC analysis) were removed from each box.

7.3 V-Tank Soil Data from Fiscal Year 2003 Sampling

This sampling covered the entire AOC, defined as an area large enough to include both TSF-09/18 and TSF-21 (along with some fringe areas) (see Figure 5-1). As reported earlier in this report, the following measurements and sampling were performed in the AOC during FY-03:

- Numerous surface measurements for gamma activity (Oertel 2003 [see Appendix B])
- Selected boreholes probing to obtain gamma readings in the vertical direction (Giles 2003 [see Appendix C])
- Four composited core samples (from two locations), undergoing a complete evaluation for radionuclides, metals, organics, etc. (See Appendix F.)

All of the data from the activities outlined in this section will be used in the data evaluation in Section 8.

7.4 Decontamination and Decommissioning Soil Data around Pipelines and Valve Boxes from Fiscal Year 2003 Sampling

Along with the CERCLA sampling effort (denoted as V-Tank sampling in FY-03), there was also soil sampling affiliated with D&D during FY-03. This soil sampling was performed to determine the extent of soil contamination due to underground piping or valve box leakages. Some of the samples from this activity are used in this report to provide additional data points for the V-Tank soil database. Decontamination and decommissioning soil data from the following sources were used:

- Five composite soil samples taken along the piping from building TAN-616 toward Valve Box #1 and north toward Valve Box #2 (see Figure 7-5)
- Three grab samples around a piping tee (near building TAN-633)
- Three grab samples 3–5 ft south of Valve Box #2 (TSF-21)
- Three grab samples 3–5 ft west of Valve Box #2 (TSF-21)
- Three grab samples 5–7 ft west of Valve Box #2 (TSF-21).

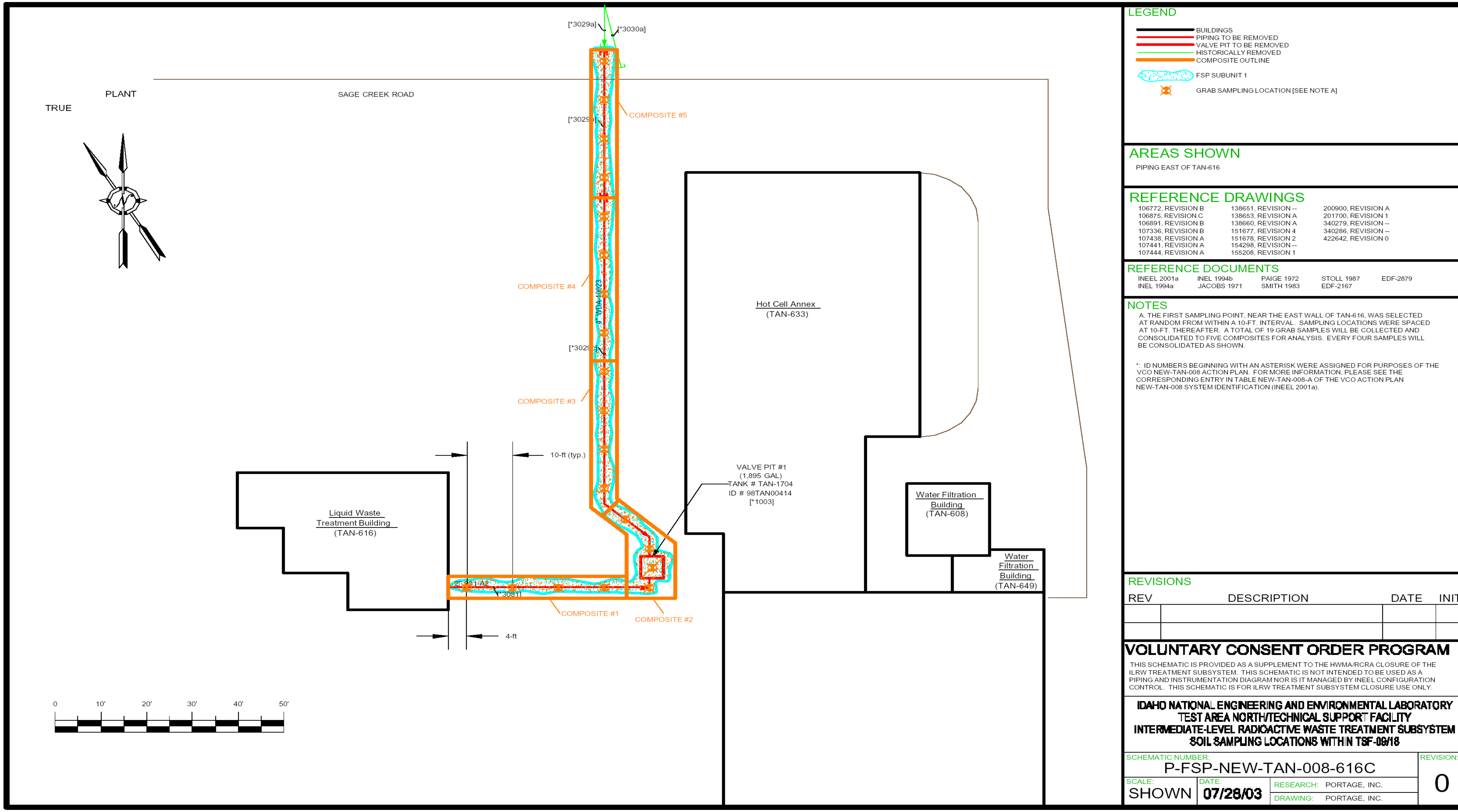

Figure 7-5. Soil sampling location for piping within FFA/CO Site TSF-09/18.

7.5 Results of Compositing Data from All Available Sources

All of the sampling efforts described in this section are outlined in Tables 7-1 and 7-2. To use data from these various sources to characterize the soil in the V-Tank area, the following assumptions were used:

- For mapping purposes (AOC maps), coordinates (x, y, z) were needed for each piece of Cs-137 data.

Table 7-1. The soil sampling at the Test Area North V-Tank area.

Sampling Year	Description of Samples	Analysis performed
1983	• Six sample locations near the V-Tanks • Results from surface to 3 ft depth, every 0.5 ft	• Gamma emitters
1988	• Three boreholes • Results from single composite at 1–2 ft	• Metals • VOCs • SVOCs • Beta/gamma (radionuclides not identified)
1993	• Three boreholes • Results from various depths: 0–2.5 ft, 6–7 ft, 18–20 ft, and 20–22 ft	• Gamma emitters • Gross alpha • Metals • VOCs • SVOCs • PCBs
1998	• Four boreholes • Results from various depths: 0–2.5 ft, 5–7.5 ft, and 7.5–10 ft[a]	• Metals • VOCs • TCLP metals • TCLP VOCs • PCB
2003	• Two boreholes • Results from two depths: shallow (0–6 ft and 0–10 ft); and deep (6–10 ft and 12–16 ft) • Surface measurements • Vertical profile measurements	• Radionuclides (gamma, beta, and alpha emitters) • Metals • VOCs • SVOCs • Herbicides/pesticides • PCBs • TCLP metals • TCLP VOCs • TCLP SVOCs • TCLP herbicides/pesticides

a. For depths 10–12.5 ft, 15–17.5 ft, and 17.5–20 ft the only analysis was for physical properties.

Table 7-2. TSF-21 and decontamination and decommissioning soil sampling.

Sampling Year	Description of Samples	Analysis performed
1993	• 3 verification soil samples from the soil directly beneath the valve pit • 1 soil boring in the center of TSF-21 • 1 soil boring 15 ft to the west of TSF-21	• Gross alpha/beta • Gamma emitters • Total metals • Total VOCs • Total SVOCs
1996	• 1 sample removed from 1 of 4 boxes of excavated TSF-21 soil	• TCLP metals • TCLP VOCs • PCBs • Gamma emitters
1997	• From the excavated TSF-21 soil: • 1 composite sample (for TCLP metals, PCBs, and radionuclide analyses) • 3 grab samples (for VOC analysis) were removed from each box	• TCLP metals • Gamma emitters • Isotopic Pu, U • Sr-90, Am-241 • Total metals • PCBs • Total VOCs
2003	• 5 composite soil samples taken along the piping from building TAN-616 that went toward Valve Box #1 and then north toward Valve Box #2 • 3 grab samples around a piping tee (near building Tan-633) • 3 grab samples 3–5 ft south of Valve Box #2 (TSF-21) • 3 grab samples 3–5 ft west of Valve Box #2 • 3 grab samples 5–7 ft west of Valve Box #2	• Radionuclides (gamma, beta, and alpha emitters) • Metals • VOCs • SVOCs • PCBs

- For general characterization (e.g., waste determinations), the data points for a given species did not require its pedigree—year, location, and depth. The data points were listed from 1,…, n, where n was the number of detects of the specie.
  - Only detected species were used in the computation of an average concentration
  - The number of detections for particular species was used to determine the degree of freedom (n-1) for 90 and 95% upper confidence limit (UCL) determinations. This was done to force a "worst-case" calculation.

Of all the species, Cs-137 had the most detected data points (75 data points). Since it was cumbersome to differentiate between whether analysis was used to detect a certain specie, or that the specie was not detected, it was decided that performing calculations on only detected values was tidier and provided a level of worst-case analysis. The concentrations from the combination of data will be presented in Section 8.

8. TSF-09/18 AND TSF-21 SITES SAMPLING DATA ANALYSIS AND INTERPRETATION

In the *Final Record of Decision for the Test Area North, Operable Unit 1-10* (DOE-ID 1999), a final remediation goal was developed for Cs-137. From an earlier risk determination, Cs-137 was the only COC in the V-Tank soil. The strategy for the AOC is laid out in the *Record of Decision Amendment for the V-Tanks (TSF-09 and TSF-18) and Explanation of Significant Differences for the PM-2A Tanks (TSF-26) and TSF-06, Area 10, at Test Area North, Operable Unit 1-10* (DOE-ID 2004a). The following text is the planned action for the V-Tank AOC as provided by Section 8 of the ROD amendment:

1. Excavating contaminated soil:

   - Excavating contaminated soil surrounding the V-Tanks that exceeds the final remedial goal (FRG) to a maximum of 3 m (10 ft) bgs

   - Excavating additional soil below 3 m (10 ft) bgs to the extent necessary to remove the V-Tanks and associated piping.

2. Disposing of the contaminated soil at an approved soil repository.

3. Post-remediation soil sampling to verify that FRGs are met and to analyze for additional contaminants if excavation indicates a release of the V-Tanks contents:

   - For contaminated soil less than 3 m (10 ft) bgs, post-remediation sampling to verify that FRGs are met.

   - For contaminated soil more than 3 m (10 ft) bgs, post-remediation sampling to determine the need for institutional controls.

   - For contaminated soil beneath the V-Tanks and piping where there is evidence of a release (either a leak from a V-Tank or the associated piping), post-remediation soil sampling at the bottom of the excavation to analyze for V-Tanks contaminants to support a risk analysis that supports a potential revision to the FRGs and a determination of the need for further actions. This determination could lead to application of institutional controls, further remediation, or no action.

   - For contaminated soil beneath the V-Tanks and piping where there is no evidence of a release from either the V-Tanks or the associated piping, post-remediation soil sampling to determine the appropriate institutional controls, if any, for this site.

4. Filling the excavated area with clean soil (soil that meets RA objectives) and then contouring and grading to the surrounding elevation.

5. Establishing and maintaining institutional controls consisting of signs, access controls, and land-use restrictions, depending on the results of post-remediation sampling. Institutional controls will be required if residual contamination precludes unrestricted land use after completion of remedial action.

In evaluation of the nature and extent of Cs-137 contamination during remediation, it is important to ensure that other detected contaminants do not also require cleanup to protect human and ecological receptors. The closure plan for the V-Tank site has a cleanup goal to remove this COC from the AOC to levels below 23.3 pCi/g. This value has been agreed to by the Agencies. The risk assessment will look at FY-03 data to determine the following assertion: When Cs-137 is below 23.3 pCi/g, are there any contaminants that pose a risk to the environment? If not, then Cs-137 becomes our "signature" contaminant to:

- Serve to formulate contamination and dig maps for the AOC
- Serve as closure verification from surface gamma measurements.

The approach is based on a documented risk assessment process (DOE-ID 1997). This process uses the assumption that the soils at the INEEL are generally remediated to total concentrations contributing less than 1.0E-04 total risk and/or a hazard index (HI) of 1.0 to the future residential human health scenario (100 years) and a HI of 10 for ecological receptors. Accepted risk-based concentrations will be used for both screening and development of cleanup criteria. The desired effect is to ensure that the remediation of sites is compliant with both CERCLA and RCRA. The risk assessment screening process is detailed and performed in Appendix H. This section will supply a summary of those results.

8.1 Evaluation of Contaminants in Soil with below the Cs-137 Final Remediation Goal

In the Record of Decision (ROD) (DOE-ID 1999) (hereinafter referred to as the ROD), a final remediation goal of 23.3 pCi/g was developed based on 1E-04 risk to a hypothetical future resident at the site, due to exposure solely from Cs-137. Any soil containing Cs-137 at 23.3 pCi/g or greater will be remediated at those sites identified in the ROD. This will remove any other contaminants that are present in this soil. However, it is important to ensure that other detected contaminants do not also require cleanup to protect human and ecological receptors.

Using the approach documented in the *Risk-Based Screening and Assessment Approach for Waste Area Group 1 Soils* (VanHorn and Stacey 2004), those soil samples where the Cs-137 concentration is below the FRG were evaluated. If no other contaminants are of concern, then Cs-137 can become our "signature" contaminant and serve to formulate contamination and dig maps for the AOC, and as closure verification from surface gamma measurements.

The data presented in Section 7 was evaluated. First the data from the V-Tank soil sampling performed in FY-03 will be assessed (see Section 7.3 and Appendix F). Second, the historical data from TSF-09/18 and TSF-21, along with FY-03 D&D sampling, was evaluated (see Section 7.1 and Appendix D; Section 7.2 and Appendix E; and Section 7.4 and Appendix G respectively).

8.1.1 Evaluation of the V-Tank Fiscal Year 2003 Data

The FY-03 soil samples for the V-Tanks were divided into a *waste management* sample (shallow sample) and a *risk assessment* sample (deeper sample). The purpose was to directly compare depth of sample with risk for areas that were assumed to require excavation. This was to allow the project to validate the assumption that the excavation maps could be directly tied to the Cs-137 concentration.

The sample numbers, sample depths, and associated contaminant concentrations are presented in Table F-1 and Appendix F. One sample location was at DS-02 (at Valve Pit #2) and the other sample was at SS-01 (southwest of Tank V-9). As is seen, both of the samples with the designation of "WM" (for waste management sample) have Cs-137 levels above the FRG and will be remediated and were not assessed further. The other two samples with the "RA" designation (for risk assessment sample) indicate samples where the Cs-137 level is lower than 23.3 pCi/g FRG and were assessed in Appendix H.

As is discussed in Appendix H, all nonradionuclide contaminants were eliminated as a concern for both human and ecological receptors. No radionuclides are of concern to ecological receptors, although Co-60 appears to remain a concern to the current worker at the 1E-06 risk. However, the concentrations of concern for both samples assessed are below the 1E-04 risk level (7.2 pCi/g) and are at depth (greater than 6 ft) and of limited extent. Additionally, a hundred years of institutional controls are already required in this area to ensure protection from Cs-137 concentrations in the general area based on the future residential scenario. Due to the short half-life of Co-60 (approximately 5 years), it will have decayed to acceptable levels during this timeframe and therefore it is not a considered a concern at this location.

8.1.2 Evaluation of the Selected Data

The soil data from TSF-09/18, TSF-21, and the D&D data having Cs-137 levels below the FRG were complied as discussed in Section 7 (subsequently referred to as the selected data) and evaluated in Appendix H. The results are summarized below.

For radionuclides:

- Co-60 was the only radionuclide that remained a risk following the initial screen (concern to the current worker). However, this is deemed acceptable at this location since the cleanup goal for Cs-137 is based on a future residential scenario and will require that institutional controls remain in place for approximately 100 years. Since Co-60 has a short half-life (~5 years), it will decay to acceptable levels during this time.

For nonradionuclides:

- Arsenic, cadmium, thallium, and vanadium exceeded the initial human health screening. Only thallium and vanadium were retained as human health risks for the next screening step. Arsenic and cadmium were both eliminated from the initial screening as concerns for a human health risk (see Apppendix H discussion). From the second screening, both vanadium and thallium remained as human health risks. A third screening eliminated both vanadium and thallium as a human health risk.

Chromium, thallium, silver, and vanadium were retained as ecological risks after the first screening and were further analyzed. Thallium and silver were eliminated as a concern during the final screening, although both chromium and vanadium could not be screened at this level. However, these contaminants are not considered to be of concern. First, both the concentrations of chromium and vanadium are 1.24 and 1.37 times background respectively. The RBCs for ecological receptors for these two contaminants would show risk at background concentrations. The documentation for chromium is still not available, and vanadium is currently under review by EPA to develop a more appropriate screening value. Finally, it is unlikely, given the limited extent of the contamination, that they would present a concern if a baseline approach was used to further assess these results.

Additionally, the detections of concern for these four contaminants all come from the D&D sampling surrounding the pipeline. All are at approximately 5 ft of depth and appear to be associated with the piping. As concluded previously, it is likely that the presence of these contaminants is unique to soil areas directly in contact with the piping. All of the piping areas fall within the prescribed area of contamination and therefore will be removed from the ground.

8.1.3 Summary of the Risk Evaluation

The evaluation of the FY-03 sampling concluded that Co-60 could be a concern to current workers. However, institutional controls in place for Cs-137 should provide protection to workers possibly exposed in the near future. Due to its short half-life (5 years), it is anticipated that the Co-60 will quickly decay to an acceptable level.

The evaluation of the other selected data indicated that there were no contaminants of concern for human health and that chromium, silver, thallium, and vanadium may be of concern for ecological receptors. The detections of concern for these four contaminants all come from the D&D sampling surrounding the pipeline. The majority of the soil in contact with waste pipes will be removed during the main excavations discussed in Section 8.2.2. It may be deemed necessary to remove any additional soil surrounding the pipes that was not removed from the main excavations.

In conclusion, using Cs-137 as the lone analyte for post remediation checks would be acceptable since these contaminants are not expected to occur away from the piping. However, confirmation sampling for selected contaminants may be required.

8.2 Area of Contamination Mapping

8.2.1 Data Usage for Cesium-137 Plots

The IT Software Engineering group at the INEEL provided computer-generated AOC maps based on Cs-137 data to pictorially display the contaminated site and to provide input to the dig maps that will be utilized. The AOC maps will be used to formulate the final excavation for the V-Tank area. The current work scope for the V-Tank area calls for three excavation stages:

- Excavate to the top of the V-Tanks
- Excavate to remove the V-Tanks from the ground
- Excavate to remove contaminated soil.

There are three main hotspots in the current AOC footprint around the V-Tanks, around Valve Pit #2, and around a piping tee near building TAN-633. The vast majority of the contamination will be removed when soil from these spots is removed. The soil from these three areas will be sent to the ICDF after the verification samples have been taken. The AOC maps will determine if there are any other locations for soil removal, otherwise the footprint of the AOC can be reduced and soil left in place.

Both surface contamination and vertical contamination data were used to develop the contamination maps (see Appendixes B and C). These data were presented as gamma emitters, primarily Cs-137 and Co-60 at various locations, and expressed with an accompanying eastings and northings coordinate. Figures 8-1, 8-2, and 8-3 illustrate the vertical profiles, in tabular form, for three different campaigns that determined Cs-137 concentrations versus depths at various sampling locations. These values illustrate that below a certain depth, the level of Cs-137 contamination lowers below the action level of 23.3 pCi/g. The sample identifiers given in Figure 8-3 can be located on Figure 7-5. Even though these charts indicate that some of the soil involved in the dig for V-Tank removal may not be in excess of 23.3 pCi/g, there are no plans to perform any soil segregation.

Depth, ft	Grid 15	Grid 22	Grid 24	Grid 34	Grid 37	Grid 38
0	49.92	678.65	110.58	66.98	113.11	784.81
0.5	193.99	1.26	25.28	31.59	325.42	30.96
1	70.77	10.11	34197.96	24.01	0.15	30.33
1.5	9.48	1.83	17.69	1.58	28940.62	0.13
2	4.42	1.83	1.58	0.13	10.11	0.13
2.5	6.32		2.09	0.32	265.39	0.00
3	9.48		1.77	1.07	12.64	1.90
	East End Tank V2	Between V1 and V2	Under Tank V3	North of all tanks	West of V-1	West of V1 and V2

NOTE: These will all be removed in the Big Dig

Decayed from 1983 to 2003

Figure 8-1. The vertical profile of Cs-137 for the soil grids from 1983 sampling (in pCi/g).
(Note: Yellow color indicates depth at which Cs-137 meets the cleanup requirement.)

Range Depth, ft	Point Depth, ft	A	B	C
0 to 0.5	0.25			
0 to 2.5	1.25	0.76		0.04
6 to 7	6.5		65.08	
18 to 20	19			13.96
20 to 22	21			
		SW of Valve Pit	West of V2	West of V3

NOTE: These will all be removed in the Big Dig

Decayed from 1993 to 2003

Figure 8-2. The vertical profile of Cs-137 for the soil locations from 1993 sampling (in pCi/g).
(Note: Yellow color indicates depth at which Cs-137 meets the cleanup requirement.)

Depth, ft	SS-01	SS-02	SS-03	SS-04	SS-05	SS-06	SS-07	SS-08	DS-01	DS-02
0	105.5								51.8	
0.25						24.4				
0.5		23.7	3.6	4.1	0		0.3	0.6		131
0.75										
1	27.2								12.5	
1.25						60.8				
1.5		18.1	1.9	3.1	-0.1		0	0.3		206.1
1.75										
2	51.7								5.1	
2.25						131.5				
2.5		4.3	0.6	4	0.1		0.1	0.2		807.1
2.75										
3	86.4								3.9	
3.25						95.3				
3.5		5.3	0.1	3.6	0.1		0	0.1		1527.8
3.75										
4	27.9								1.8	
4.25						23.4				
4.5		3.2	0.3	11.9	0.1		0.1	0.1		1898.7
4.75										
5	40.4								0.7	
5.25						22.5				
5.5		2.5	0	15.4	0		0.1	0		1770.5
5.75										
6	25.8								0.6	
6.25						36				
6.5		3.7	0	7.6	0.2		0.1	0		2284.8
6.75										
7	20								1	
7.25						4				
7.5		5.3	0	5.5	0.1		0.1	0		1138.5
7.75										
8	14								1	
8.25						2.9				
8.5		6.3	0	1.1	0		-0.1	0		222.5
8.75										
9	7.8								0.8	
9.25						5				
9.5		6.6	0	0.3	0.1		-0.1	0		6.6
9.75										
10	12.8								1.2	
										2.3

Figure 8-3. The vertical profile of Cs-137 for the soil locations from 2003 borehole analysis (in pCi/g). (Note: Yellow color indicates depth at which Cs-137 meets the cleanup requirement.)

The data for the surface measurements (Appendix B) was plotted for Cs-137 (the COC for the V-Tank area). Figure 8-4 depicts the AOC based on the surface measurements. The red denotes surface areas where Cs-137 has concentrations in excess of 23.3 pCi/g (the final remediation goal). While the red area in the figure is considered to help define the AOC, potential gamma interference may exist from a temporary storage area containing radioactively hot waste samples where building TAN-615 once stood. According to Paul Sloan, project field team leader, the sampling team indicated that there might be an influence of "radioactive shine" as a result of this storage area (i.e., a false positive of a Cs-137 source emanating from the soil). This assertion is supported from gamma data taken from the vertical borehole well SS-08 (see Figure 5-1). The data for this well is given in Figure 8-3. At 6 in. below the surface, this borehole produced a reading of 0.6 pCi/g, the largest source term value in this well. The location of SS-08 would put it in the AOC as predicted by the surface readings.

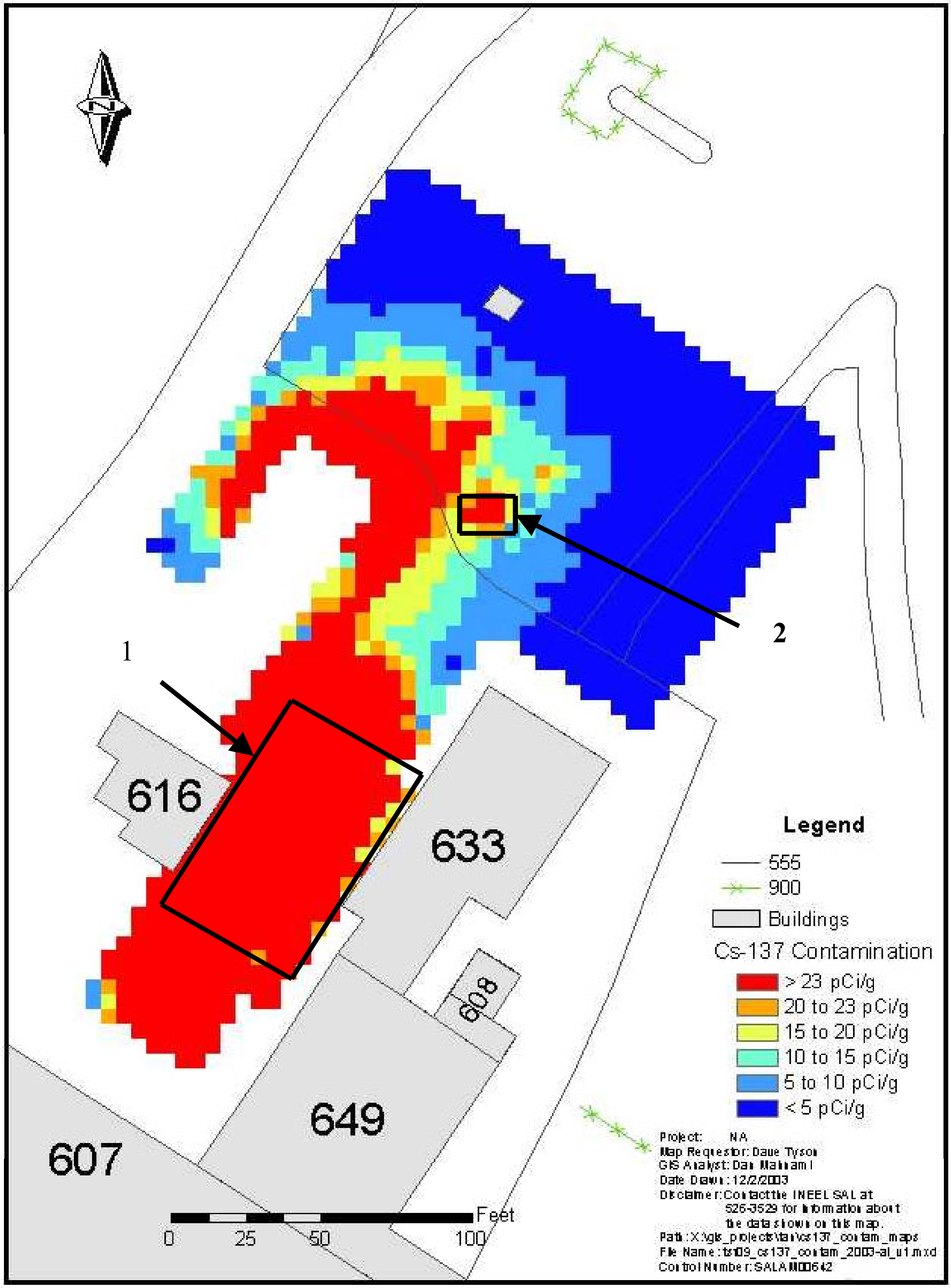

Figure 8-4. The area of contamination based on surface gamma (Cs-137) measurements. (Boxes 1 and 2 schematically represent TSF-09/18 and TSF-21, respectively.)

Spatial Analysis Laboratory was used to construct a three-dimensional model of all of the Cs-137 data collected in the vicinity of the V-Tanks. The data sets include the surface gamma survey, the borehole gamma analysis, and any analytical analyses of samples sent to off-Site laboratories (see Section 8.3 for details on these data sets). For the model, the Cs-137 concentrations were provided in spatial coordinates of eastings, northings, and depth. The Cs-137 contamination in the V-Tank area is related to a surface spill near the tanks and to leaking pipes (tee joint) and valves (TSF-21). Initial modeling of the contamination verified that these were indeed the major spots to target for excavation.

All cesium sample results were assembled into spreadsheets. The location information was verified against existing Geographic Information Systems (GIS) data layers, and a check plot of the sample locations was prepared. Visual inspection showed that no samples had an improbable location. All of the locations and results were assembled into an access database, and the Environmental Visualization System (EVS) reporting module was used to prepare the input to the modeling environment.

The data were processed by the three-dimensional Krig module. This module accepted all of the default parameters from the EVS-Pro software package. This step was performed to ensure that a reasonable model could be constructed from the data set (visually inspected for outliers in three dimensions). After the data were visually inspected, sensitivity analyses were performed for the reach, number-of-points, and anisotropy parameters for the model. The goal of the sensitivity analysis was to ensure that the actual data points were honored, and to accommodate additional information that the project engineers had about the situation in the vicinity.

Data were clipped to the surface of the earth. The package automatically clips data to the maximum and minimum northing and easting of the input data set (this ensures that all values are interpolated among real samples and not extrapolated beyond the sample network). By trial and error, the search radius for each computed point in the output regular lattice was set at 20 ft (in any direction). The horizontal/vertical anisotropy variable basically sets the horizontal to vertical travel distance of a spill or leak. This ratio was set to 10, based on other studies done in the same region with this tool set. Based on the density of real sample values in the lattice, the software determined that 20 points within the search radius was sufficient for krigging, and this parameter was left to default. A three-dimensional model was then constructed and exported as virtual reality markup language (VRML). Depiction of a footprint (Figure 8-5) and a subterranean elevation (Figure 8-6) are provided from the three-dimensional maps. This model was also used as input to extract horizontal isolines from the plume. The plume isovolume was set at 23.3 pCi/g for Cs-137 and horizontal isolines were extracted from the surface and at each foot below until the plume disappeared at about 9 ft below the surface. Each isoline was prepared as a separate Drawing Interchange Format (DXF) file and given to engineering to assist in preparing dig drawings via Autocad.

8.2.2 Soil Removal Strategy Based on Contamination Maps

The contamination maps (as depicted in Figures 8-4, 8-5, and 8-6) confirm the existence of three main sources of contamination:

- TSF-9/18 around the V-Tanks—A known spill from a tanker truck (1982), potential leaks around Valve Box #1 and other associated piping in the area

- TSF-21 (Valve Box #2)—Previous removal actions resulted in known accidental drainings out of the box and suspected pipe leaks were both causes of soil contamination

- Piping tee (from an underground waste pipe from building TAN-633 that joins into the pipeline connecting Valve Pit #1 and #2)—This area was found to have contamination from a probable leak during 2003 D&D operations.

The AOC excavation map, developed for the Remedial Action/Remedial Design, is shown in Figure 8-7. The excavation map shows the three digging locations where process knowledge indicates the existence of contamination. The three-dimensional Cs-137 contamination plot uses, as part of its data base, gamma data from surface surveys in the generation of three-dimensional contamination plots. Dig maps would lead to the necessity for shallow soil removal in this location around the storage area. The decision from the project, as will be described later in this section, was to not dig in that area. Confirmation gamma screens will be used to verify this decision. The excavation areas in the figure are depicted in pink. Areas needing confirmation checks, or to be used for staging soils/tanks, are shown in gray.

TSF-9/18 around the V-Tanks —The V-Tank excavation area is the large area located over and around the V-Tanks. This excavation is expected to encompass 107 × 84.8 ft (9,084 ft^2). The maximum depth of the excavation is bounded by a depth of 23 ft. Depth to the top of the V-Tanks is approximately 10 ft with piping extending above the V-Tanks approximately 2 ft above the tops.

TSF-21 (Valve Box #2)—The Valve Pit excavation area is a 57-ft square area (3,250 ft^2) located northeast of the V-Tanks. The maximum depth of this excavation is bounded by to a depth of 18 ft.

Piping tee contamination—This excavation area is located adjacent to the V-Tanks excavation area on the northeast side; its dimensions are 33.1 × 30.5 ft (1,010 ft^2). The maximum depth of the excavation is bounded by to a depth of 10 ft.

Figure 8-5. Footprint view of the V-Tanks contamination volume.

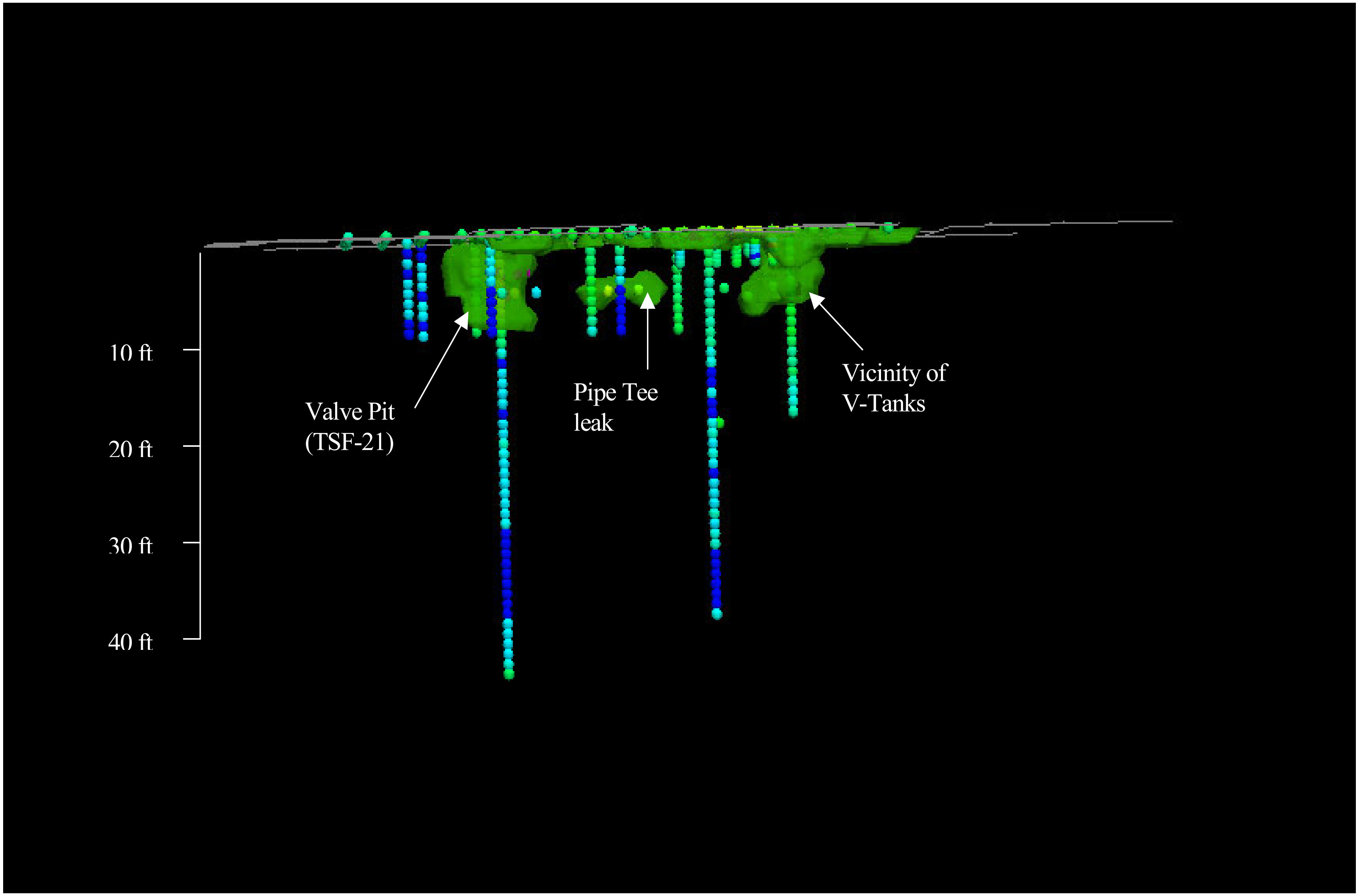

Figure 8-6. Elevation view of the depths below the soil in the V-Tank area looking toward plant-east. (Note: Each sphere represents 1 foot.)

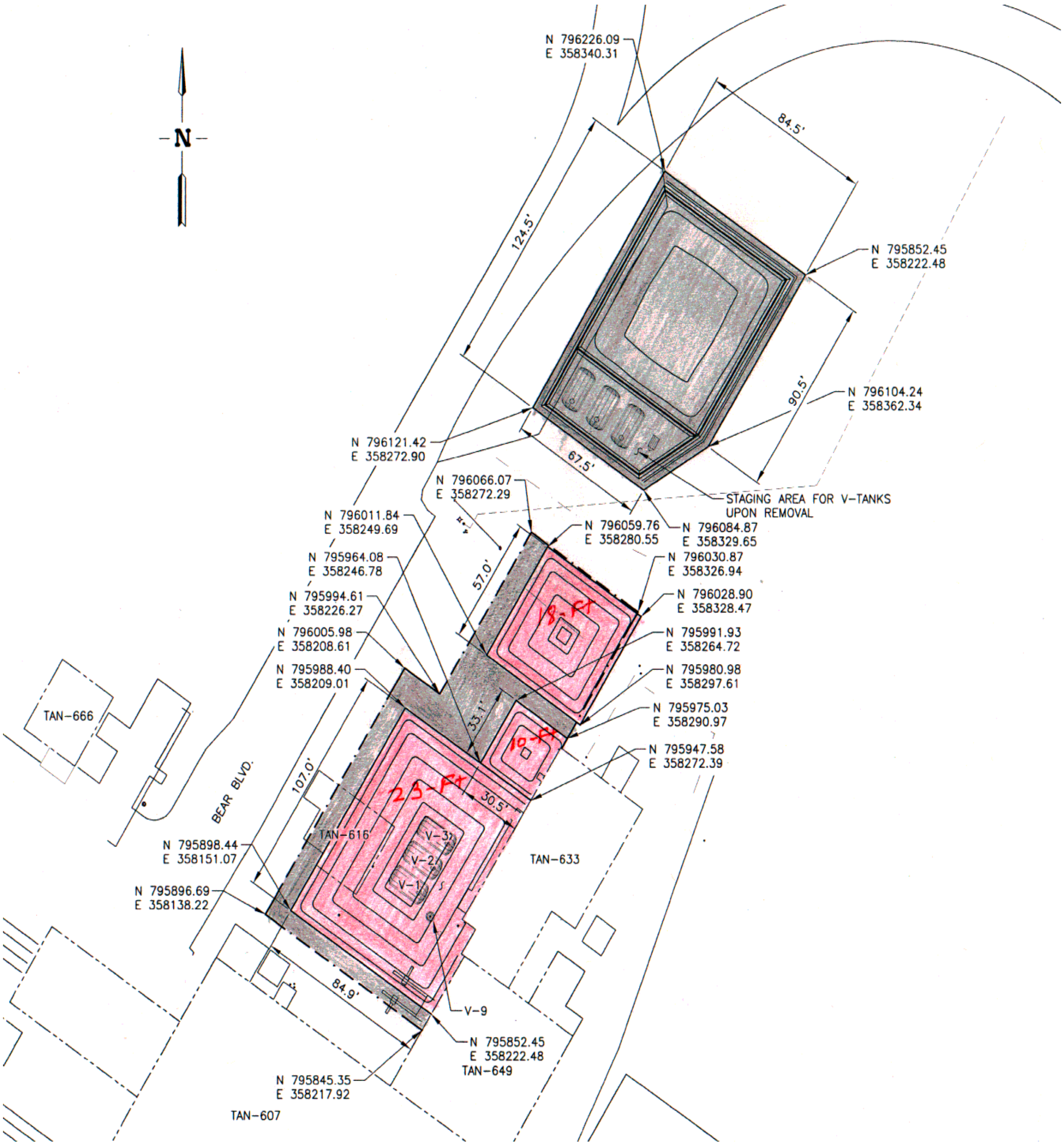

Figure 8-7. Configuration of the V-Tank area excavation.

The soil area denoted by the gray color around the three excavations is assumed to be within the preliminary remediation goal (PRG) criteria (Cs-137 below 23.3 nCi/g). However, due to uncertainties caused by the surface gamma survey—areas above 23.3 nCi/g for Cs-137 where hot waste containers were staged—there are plans to perform verification gamma screens in those areas. Soil pucks will be pulled from locations in this area to perform spot-checks on Cs-137 concentration; the pucks will be analyzed away from the waste containers to avoid false positive readings. This gray area is an approximate 9-ft corridor located around the pit excavation areas and includes areas located between the excavation pits. In the event that a puck sample contained enough Cs-137 to be in excess of the PRG criteria, soil removal to pre-designated depth (e.g., 1.5 ft), would be done and verification on the scraped area.

A tank lay-down area is located northeast (plant north) of the pit areas (also shown in gray). This area encompasses both the area where the tanks will be staged after excavation and the soil pile area resulting from our excavation.

8.3 Soil Characterization for Disposal

8.3.1 Characterization from Fiscal Year 2003 V-Tank (CERCLA) Data

Following excavation, the removed soil will be sent to the ICDF landfill. The SSs of soil from FY-03 V-Tank sampling were subjected to TCLP testing to determine if the soil carries any characteristic codes (Table 8-1) in addition to the F001 code (Table 8-2).

Table 8-1. Toxicity characteristic leaching procedure results for the V-Tank soils.

Waste Code	Hazardous Constituent	TCLP Limit (mg/L)	1WM75101	1WM75001	Average	Standard Error	90% UCL	95% UCL
D004	Arsenic	5	0.033	0.033	NA	NA	NA	NA
D005	Barium	100	**1.55**	**1.91**	1.73	0.18	2.283983	2.866
D006	Cadmium	1	**0.015**	**0.008**	0.0115	0.0035	0.022272	0.034
D007	Chromium	5	0.017	0.017	NA	NA	NA	NA
D008	Lead	5	0.024	0.024	NA	NA	NA	NA
D009	Mercury	0.2	0.0003	0.001	NA	NA	NA	NA
D010	Selenium	1	0.034	0.034	NA	NA	NA	NA
D011	Silver	5	0.017	0.017	NA	NA	NA	NA
D012	Endrin	0.02	0.0006	0.0006	NA	NA	NA	NA
D013	Lindane	0.4	0.04	0.04	NA	NA	NA	NA
D014	Methoxychlor	10	0.018	0.018	NA	NA	NA	NA
D015	Toxaphene	0.5	0.025	0.025	NA	NA	NA	NA
D016	2,4-D	10.0	0.12	0.12	NA	NA	NA	NA
D017	2,4,5-TP (Silvex)	1.0	0.017	0.017	NA	NA	NA	NA
D018	Benzene	0.5	0.05	0.05	NA	NA	NA	NA
D019	Carbon Tetrachloride	0.5	0.05	0.05	NA	NA	NA	NA
D020	Chlordane	0.03	0.0014	0.0014	NA	NA	NA	NA
D021	Chlorobenzene	100.0	0.05	0.05	NA	NA	NA	NA
D022	Chloroform	6.0	0.05	0.05	NA	NA	NA	NA
D023	o-Cresol	200.0	0.05	0.05	NA	NA	NA	NA
D024	m-Cresol	200.0	0.05	0.05	NA	NA	NA	NA
D025	p-Cresol	200.0	0.05	0.05	NA	NA	NA	NA
D026	Cresol	200.0	0.15	0.15	NA	NA	NA	NA
D027	1,4-Dichlorobenzene	7.5	0.05	0.05	NA	NA	NA	NA

Table 8-1. (continued).

Waste Code	Hazardous Constituent	TCLP Limit (mg/L)	1WM75101	1WM75001	Average	Standard Error	90% UCL	95% UCL
D028	1,2-Dichloroethane	0.5	0.05	0.05	NA	NA	NA	NA
D029	1,1-Dichloroethylene	0.7	0.05	0.05	NA	NA	NA	NA
D030	2,4-Dinitrotoluene	0.13	0.05	0.05	NA	NA	NA	NA
D031	Heptachlor (& its epoxide)	0.008	0.0011	0.0011	NA	NA	NA	NA
D032	Hexachlorobenzene	0.13	0.05	0.05	NA	NA	NA	NA
D033	Hexachlorobutadiene	0.5	0.05	0.05	NA	NA	NA	NA
D034	Hexachloroethane	3.0	0.05	0.05	NA	NA	NA	NA
D035	Methyl Ethyl Ketone	200.0	0.05	0.05	NA	NA	NA	NA
D036	Nitrobenzene	2.0	0.05	0.05	NA	NA	NA	NA
D037	Pentachlorophenol	100.0	0.25	0.25	NA	NA	NA	NA
D038	Pyridine	5.0	0.05	0.05	NA	NA	NA	NA
D039	Tetrachloroethylene	0.7	0.05	0.05	NA	NA	NA	NA
D040	Trichloroethylene	0.5	0.05	0.05	NA	NA	NA	NA
D041	2,4,5-Trichlorophenol	400.0	0.05	0.05	NA	NA	NA	NA
D042	2,4,6-Trichlorophenol	2.0	0.05	0.05	NA	NA	NA	NA
D043	Vinyl Chloride	0.2	0.05	0.05	NA	NA	NA	NA

Note: Bold text denotes values above the detection limits.

Table 8-2. Treatment standard check for F001 waste code (units = mg/kg).

Compound	Treatment Standard	1WM75101VL	1WM75001VL	Average	Standard Error	95% UCL
1,1,1-Trichloroethane	**6**	0.011	0.012	NA	NA	NA
Trichloroethene	**6**	**0.0009**	**0.0017**	0.0013	0.0004	**3.83E-03**
Tetrachloroethene	**6**	0.011	0.012	NA	NA	NA

Note: Bold text denotes values above the detection limits.

When comparing the FY-03 soil data to the ICDF Waste Acceptance Criteria (WAC), the following was noted:

- 2-nitroaniline, 3-nitroaniline, and 4-nitroaniline were analyzed at detection levels that were 10 times above the WAC guideline concentration with no detection measured

- Cm-243/244, Nb-94, and Ni-63 were detected radioisotopes that have no WAC guideline concentration.

Assuming that the above issues can be resolved, it is anticipated that the excavated soil can be disposed of at the ICDF.

As can be seen from Table 8-1, there would be no additional D-codes that would be applied to the soils. Since the soils have an F001 code attached, trichloroethylene, tetrachloroethylene, and 1,1,1-trichloroethane need to have their concentrations checked against the treatment standard. The soils do not require treatment prior to land disposal (see Table 8-2).

8.3.2 Characterization from the Entire Data Population

Since the data from FY-03 CERCLA fielding sampling was limited to only two samples, data from other sources were needed to provide enough data that statistical techniques could be applied. The data that is used for developing the waste profile for the excavated soil is from the following sources:

- TSF-09/18 historical data (1983, 1988, 1993, and 1998)
- TSF-21 historical data (1993, 1996, and 1997)
- V-Tank soil sampling in FY-03
- Current (ongoing) D&D sampling around piping and valve pits.

In order to provide data for a hazardous waste determination, the TCLP data from the following sets were used:

- TCLP (metals, VOCs) from TSF-09/18 sampling in 1998 (13 data points)
- TCLP (metals, VOCs) from TSF-21 sampling in 1996 (1 data point)
- TCLP (metals) from TSF-21 sampling in 1997 (5 data points)
- TCLP (metals, VOCs, SVOCs, herbicides, and pesticides) in 2003 sampling (2 data points).

These TCLP data points were laid out in a spreadsheet (see Table 8-3) that shows the following for each characteristic specie (D004 to D043): the lowest TCLP concentration, the highest TCLP concentration, the average TCLP concentration, the standard error, and the 90% UCL TCLP concentration.[d] Most of the TCLP concentrations were at detection levels and none of the 90% UCLs were above the regulatory levels. The data indicates that the soils do not exhibit land disposal restricted characteristics (D-codes) as defined by 40 CFR 261, "Identification and Listing of Hazardous Waste."

Another spreadsheet (see Table 8-4) was developed to determine the hazardous constituent contents of the V-Tank soils. Data from the TSF-09/18 historical data, the TSF-21 historical data, the V-Tank soil sampling in FY-03, and the current (ongoing) D&D sampling around piping and valve pits were utilized to determine the source terms. For this analysis, only detected species were used in the computation, and the number of detections was used to determine a specie's degree of freedom for 95% UCL determinations. This was done to force a "worst-case" calculation. As many as 75 data points were used for a given specie, with Cs-137 having the most detected data points (75 data points). From this information, a spreadsheet was developed with the following data for a given specie: the number of detects, the lowest concentration, the highest concentration, the average concentration, the standard error, and the 95% UCL concentration.

It should be noted that not all of the historical data have undergone validation. Attempts to locate old validation reports have been performed. It is assumed that due to the lack of sampling locations from 2003 sampling (two locations and four samples), all available data (past and present) were needed for waste characterization. As a result, although a fair number of the data have been validated, not all have been. The project has accepted the trade-off between a smaller validated data set and a larger data set with most of the data validated.

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d. The detection levels are based on reporting levels that would not exceed those given for characterization (40 CFR 261) and for universal treatment standards (40 CFR 268). In some cases, these were not less than ICDF WACs. If difficulties in disposition of the waste result from the reported detection levels (RDLs), lower values obtained from the method detection limits (MDLs) will be investigated.

Table 8-3. Toxicity characteristic leaching procedure data for V-Tank soil based on all available data.

Waste Code	Hazardous Constituent	TCLP Limit (mg/L)	V-Tank Soil 2003	V-Tank Soil 2003	V-Tank Soil 1998	V-Tank Soil 1998	V-Tank Soil 1998	V-Tank Soil 1998	V-Tank Soil 1998	V-Tank Soil 1998	V-Tank Soil 1998	V-Tank Soil 1998	V-Tank Soil 1998	V-Tank Soil 1998	V-Tank Soil 1998	V-Tank Soil 1998	V-Tank Soil 1998	TSF-21 1996	TSF-21 1997 Box 1	TSF-21 1997 Box 3	TSF-21 1997 Box 4	TSF-21 1997 Box 3	TSF-21 1997Box 5	Low	High	Average	St. Error	90% UCL
D004	Arsenic	5	0.033	0.033	0.0208	0.0208	0.0208	0.0208	0.0208	0.0208	0.0208	0.0208	0.0208	0.0208	0.0208	0.0208	0.0208	0.034	0.019	0.019	0.019	0.019	0.019	0.340	0.340	0.340	NA	NA
D005	Barium	100	1.55	1.91	1.39	2.335	2.369	1.339	1.623	1.516	1.519	1.948	2.15	0.923	1.273	1.371	1.786	2.000	1.649	1.671	1.462	1.620	1.738	0.923	2.369	1.688	0.101	1.824
D006	Cadmium	1	0.015	0.008	0.0053	0.0126	0.0118	0.0074	0.0043	0.0061	0.006	0.0058	0.0063	0.0052	0.0051	0.0059	0.007	0.003	0.006	0.006	0.007	0.006	0.009	0.005	0.015	0.008	0.001	0.009
D007	Chromium	5	0.017	0.017	0.004	0.004	0.0043	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.005	0.007	0.007	0.007	0.007	0.007	0.0043	0.0043	0.0043	NA	NA
D008	Lead	5	0.024	0.024	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.048	0.026	0.030	0.030	0.030	0.030	0.035	NA	NA	NA	NA	NA
D009	Mercury	0.2	0.0003	0.001	0.00014	0.00014	0.0002	0.00014	0.00014	0.00016	0.00014	0.00014	0.00014	0.00014	0.00014	0.00018	0.00034	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.00014	0.00034	0.00020	0.00004	0.00026
D010	Selenium	1	0.034	0.034	0.0254	0.0254	0.0254	0.0254	0.0254	0.0254	0.0254	0.0254	0.0254	0.0254	0.0254	0.0254	0.0254	0.036	0.040	0.040	0.040	0.040	0.040	NA	NA	NA	NA	NA
D011	Silver	5	0.017	0.017	0.0071	0.0089	0.0089	0.0071	0.0071	0.0071	0.0071	0.0071	0.0071	0.0071	0.0071	0.0071	0.0071	0.007	0.005	0.005	0.005	0.005	0.005	0.0089	0.0089	0.0089	NA	NA
D012	Endrin	0.02	0.0006	0.0006																				NA	NA	NA	NA	NA
D013	Lindane	0.4	0.04	0.04																				NA	NA	NA	NA	NA
D014	Methoxychlor	10	0.018	0.018																				NA	NA	NA	NA	NA
D015	Toxaphene	0.5	0.025	0.025																				NA	NA	NA	NA	NA
D016	2,4-D	10.0	0.12	0.12																				NA	NA	NA	NA	NA
D017	2,4,5-TP (Silvex)	1.0	0.017	0.017																				NA	NA	NA	NA	NA
D018	Benzene	0.5	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05		0.05	0.05	0.050						NA	NA	NA	NA	NA
D019	Carbon Tetrachloride	0.5	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05		0.05	0.05	0.050						NA	NA	NA	NA	NA
D020	Chlordane	0.03	0.0014	0.0014																				NA	NA	NA	NA	NA
D021	Chlorobenzene	100.0	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05		0.05	0.05	0.050						NA	NA	NA	NA	NA
D022	Chloroform	6.0	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05		0.05	0.05	0.050						NA	NA	NA	NA	NA
D023	o-Cresol	200.0	0.05	0.05																				NA	NA	NA	NA	NA
D024	m-Cresol	200.0	0.05	0.05																				NA	NA	NA	NA	NA
D025	p-Cresol	200.0	0.05	0.05																				NA	NA	NA	NA	NA
D026	Cresol	200.0	0.15	0.15																				NA	NA	NA	NA	NA
D027	1,4-Dichlorobenzene	7.5	0.05	0.05																				NA	NA	NA	NA	NA
D028	1,2-Dichloroethane	0.5	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05		0.05	0.05	0.050						NA	NA	NA	NA	NA
D029	1,1-Dichloroethylene	0.7	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05		0.05	0.05	0.050						NA	NA	NA	NA	NA
D030	2,4-Dinitrotoluene	0.13	0.05	0.05																				NA	NA	NA	NA	NA
D031	Heptachlor (& its epoxide)	0.008	0.0011	0.0011																				NA	NA	NA	NA	NA
D032	Hexachlorobenzene	0.13	0.05	0.05																				NA	NA	NA	NA	NA
D033	Hexachlorobutadiene	0.5	0.05	0.05																				NA	NA	NA	NA	NA
D034	Hexachloroethane	3.0	0.05	0.05																				NA	NA	NA	NA	NA
D035	Methyl Ethyl Ketone	200.0	0.05	0.05	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.075	0.097		0.2	0.094	0.100						0.075	0.097	0.08867	0.00689	0.10165
D036	Nitrobenzene	2.0	0.05	0.05																				NA	NA	NA	NA	NA
D037	Pentachlorophenol	100.0	0.25	0.25																				NA	NA	NA	NA	NA
D038	Pyridine	5.0	0.05	0.05																				NA	NA	NA	NA	NA
D039	Tetrachloroethylene	0.7	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05		0.05	0.05	0.050						NA	NA	NA	NA	NA
D040	Trichloroethylene	0.5	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05		0.05	0.05	0.050						NA	NA	NA	NA	NA
D041	2,4,5-Trichlorophenol	400.0	0.05	0.05																				NA	NA	NA	NA	NA
D042	2,4,6-Trichlorophenol	2.0	0.05	0.05																				NA	NA	NA	NA	NA
D043	Vinyl Chloride	0.2	0.05	0.05	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		0.1	0.1	0.100						NA	NA	NA	NA	NA

Table 8-4. V-Tank soil concentrations based on all available data.

No. of Detects	Compound Mg/kg	Low	High	Average	St. Error	95% ucl
7	Aluminum	1.01E+04	1.66E+04	1.38E+04	8.90E+02	1.55E+04
4	Antimony	3.99E-01	8.42E-01	6.45E-01	9.17E-02	8.61E-01
25	Arsenic	8.60E+00	2.92E+01	1.76E+01	1.21E+00	1.96E+01
35	Barium	9.96E+01	2.77E+02	2.17E+02	7.56E+00	2.29E+02
19	Beryllium	6.67E-01	1.80E+00	9.85E-01	8.04E-02	1.12E+00
35	Cadmium	4.08E-01	2.70E+00	1.36E+00	9.79E-02	1.53E+00
7	Calcium	3.98E+04	1.48E+05	9.67E+04	1.23E+04	1.21E+05
35	Chromium	1.42E+01	5.27E+01	3.23E+01	1.50E+00	3.48E+01
25	Cobalt	4.35E+00	9.63E+00	7.23E+00	2.80E-01	7.71E+00
25	Copper	1.28E+01	3.23E+01	2.18E+01	9.07E-01	2.34E+01
7	Iron	1.27E+04	2.20E+04	1.83E+04	1.13E+03	2.05E+04
35	Lead	8.10E+00	2.86E+01	2.04E+01	8.23E-01	2.18E+01
7	Magnesium	1.07E+04	1.41E+04	1.25E+04	4.39E+02	1.33E+04
7	Manganese	2.50E+02	4.58E+02	3.84E+02	2.50E+01	4.32E+02
20	Mercury	1.40E-02	1.26E-01	4.73E-02	7.10E-03	5.95E-02
25	Nickel	2.20E+01	3.65E+01	3.03E+01	8.70E-01	3.18E+01
7	Potassium	1.94E+03	3.80E+03	2.70E+03	2.20E+02	3.13E+03
4	Selenium	8.24E-01	1.47E+00	1.12E+00	1.42E-01	1.46E+00
7	Silver	4.25E-01	2.87E+00	1.22E+00	2.89E-01	1.78E+00
7	Sodium	1.92E+02	1.26E+03	5.40E+02	1.38E+02	8.08E+02
9	Thallium	9.50E+00	4.44E+01	2.13E+01	5.01E+00	3.06E+01
25	Vanadium	3.30E+01	6.85E+01	5.25E+01	1.98E+00	5.59E+01
25	Zinc	6.70E+01	1.37E+02	1.00E+02	3.10E+00	1.05E+02
1	Tin	4.95E+00	4.95E+00	4.95E+00	NA	NA
	mg/kg					
3	Cyanide (Total)	9.67E-03	6.19E-02	4.05E-02	1.58E-02	8.67E-02
5	Fluoride	1.66E+00	3.11E+00	2.55E+00	2.41E-01	3.06E+00
	ug/kg					
14	Trichloroethene	5.80E-01	2.00E+01	4.61E+00	1.63E+00	7.49E+00
1	Benzo(a)pyrene	1.20E+02	1.20E+02	1.20E+02	NA	NA
1	Benzo(g,h,i)perylene	1.20E+02	1.20E+02	1.20E+02	NA	NA
15	Acetone	4.00E+00	4.10E+01	1.37E+01	2.52E+00	1.81E+01
30	Toluene	5.00E-01	5.60E+01	4.71E+00	1.89E+00	7.91E+00
2	1,1,1-Trichloroethane	6.80E-01	9.80E-01	8.30E-01	1.50E-01	1.78E+00
1	Phenanthrene	2.97E+01	2.97E+01	2.97E+01	NA	NA
1	Fluoranthene	2.08E+01	2.08E+01	2.08E+01	NA	NA
16	Aroclor-1254	2.30E+00	1.09E+03	8.85E+01	6.67E+01	2.05E+02
14	Aroclor-1260	1.50E+00	1.77E+02	3.12E+01	1.52E+01	5.81E+01
1	Tetrachloroethylene	1.00E+00	1.00E+00	1.00E+00	NA	NA
3	Eicosane	2.43E+01	1.87E+04	6.26E+03	6.22E+03	2.44E+04
1	Fluorene	5.50E+00	5.50E+00	5.50E+00	NA	NA

Table 8-4. (continued).

No. of Detects	Compound Mg/kg	Low	High	Average	St. Error	95% ucl
1	Bis(2-ethylhexyl) phthalate	3.55E+03	3.55E+03	3.55E+03	NA	NA
1	1,1,2,2-tetrachloroethane	1.95E+02	1.95E+02	1.95E+02	NA	NA
1	Diethyl Phthalate	1.14E+02	1.14E+02	1.14E+02	NA	NA
2	Ethylbenzene	2.00E+00	2.00E+00	2.00E+00	0.00E+00	2.00E+00
11	Xylenes (total)	2.00E+00	1.30E+01	4.82E+00	1.20E+00	6.99E+00
1	Methyl Ethyl Ketone	2.40E+01	2.40E+01	2.40E+01	NA	NA
5	Methylene Chloride	3.00E+00	6.20E+01	2.34E+01	1.23E+01	4.95E+01
1	Di-n-butylphalate	4.40E+01	4.40E+01	4.40E+01	NA	NA
1	Carbon Disulfide	4.00E+00	4.00E+00	4.00E+00	NA	NA
	pCi/g					
2	Americium-241	8.97E-02	1.21E-01	1.05E-01	1.57E-02	2.04E-01
2	Curium-243/244	1.94E-02	4.86E-02	3.40E-02	1.46E-02	1.26E-01
1	Plutonium-238	6.49E-01	6.49E-01	6.49E-01	NA	NA
2	Plutonium-239/240	9.58E-02	3.51E+00	1.80E+00	1.71E+00	1.26E+01
9	Uranium-233/234	9.09E-01	4.86E+00	2.35E+00	4.21E-01	3.13E+00
4	Uranium-235	6.59E-02	5.92E-01	2.85E-01	1.15E-01	5.55E-01
9	Uranium-238	7.61E-01	1.35E+00	1.10E+00	5.50E-02	1.20E+00
23	Sr-90	2.24E+00	1.50E+03	1.71E+02	6.86E+01	2.88E+02
4	Ni-63	3.65E+00	1.20E+02	3.85E+01	2.73E+01	1.03E+02
65	Cobalt-60	1.44E-02	2.53E+02	6.67E+00	3.97E+00	1.33E+01
75	Cesium-137	5.00E-02	3.42E+04	1.27E+03	6.24E+02	2.31E+03
4	Europium-152	1.82E-01	2.75E+00	1.10E+00	5.97E-01	2.51E+00
6	Europium-154	7.65E-02	1.28E+00	4.01E-01	1.82E-01	7.68E-01
44	Potassium-40	0.00E+00	1.83E+01	1.07E+01	6.01E-01	1.17E+01
1	Niobium-94	1.83E+00	1.83E+00	1.83E+00	NA	NA
22	Radium-226	5.73E-01	1.20E+00	9.58E-01	3.73E-02	1.02E+00
2	Uranium-235	1.47E-01	1.87E+00	1.01E+00	8.62E-01	6.45E+00
2	H-3	2.85E+01	4.79E+01	3.82E+01	9.70E+00	9.94E+01
6	Niobium-95	3.07E-02	5.23E-02	4.29E-02	2.94E-03	4.88E-02
15	Silver-110m	8.50E-02	6.58E+02	5.18E+01	4.34E+01	1.28E+02
10	Cesium-134	3.53E-02	1.37E-01	7.00E-02	1.16E-02	9.13E-02
1	Manganese-54	3.45E-02	3.45E-02	3.45E-02	NA	NA
2	Cerium-144	3.05E-01	5.34E-01	4.20E-01	1.15E-01	1.14E+00
4	Europium-155	7.82E-02	2.58E-01	1.40E-01	4.04E-02	2.35E-01
1	Ruthenium-106	9.21E-01	9.21E-01	9.21E-01	NA	NA
1	Zirconium-95	5.30E-02	5.30E-02	5.30E-02	NA	NA
3	Silver-108m	4.30E-02	1.16E+00	5.06E-01	3.36E-01	1.49E+00

9. V-9 TANK ISOLATION

The initial scope defined for the V-9 isolation work consisted of (1) removing the sand filter and abandoned tank supports located on the east side of TAN-616 in the area requiring excavation for V-9 outlet line isolation, (2) excavating to expose the Tank V-9 outlet line where it penetrates the building wall, (3) cutting and removing a section of the V-9 outlet line approximately 6 in. from the wall, and (4) placing plugs in the open ends of the V-9 outlet line, thereby isolating Tank V-9.

A summary of the V-9 isolation work can be separated into the following activities:

- Information on the internal inspection, verification, and removal of the sand filter from the excavation area, which is summarized in Section 9.1 of this report

- Information on inspection and isolation of the outlet line for Tank V-9 (the only remaining line that was still connected between Tank V-9 and the other V-Tanks), which is summarized in Section 9.2 of this report.

Details of these activities are discussed below.

9.1 Inspection and Removal of the Sand Filter and Abandoned Tank Supports from the V-Tank Area of Contamination

The sand filter is located adjacent to the south side of the V-1 metal riser culvert and was apparently designed to remove particulates from the Tank V-9 effluent. The sand filter is an aboveground concrete box with outer dimensions of approximately 1.5 m (5 ft) wide × 1 m (3 ft) deep × 1 m (3 ft) high. The walls of the sand filter are 10–15 cm (4–6 in.) thick. The box resides on a concrete pad slightly wider than the outside dimensions. Historic information indicates that the sand filter was used for only one day before it became plugged and has not been used since (DOE-ID 2004b). Its approximate location to Tank V-9 makes it necessary to remove it from the V-Tank area as part of the ERA.

An initial inspection and sample analysis of the sand filter contents was performed in 1997. Although much of the sand filter contents had already been removed, it appeared that approximately 19 L (5 gal) of material remained in the bottom. The residual material in the sand filter resembled potting soil in both color and texture. Samples of this residual material were then taken to determine its characteristic designation.

Results of the sand filter sample analysis are documented in the initial RD/RA Work Plan for OU 1-10, Group 2 sites (DOE-ID 2002). The results indicated the presence of 290 mg/kg of PCBs in the residues along with high concentrations of radionuclides (e.g., Co-60, Sr-90, Tc-99, Cs-137, U-234, and U-235), and gross alpha and beta concentrations of 1.65×10^4 picocuries per gram (pCi/g) and 3.73×10^5 pCi/g, respectively (DOE-ID 2004b, see Appendix H). However, the lack of any D-code contaminants in the residues (or any F001-listed contaminants above treatment standards) meant that the residual waste material met the ICDF Waste Acceptance Criteria for PCBs (500 mg/kg) and liquids (none allowed), as well as LDRs for all potential COPCs, without any additional waste treatment. Therefore, the waste material could be disposed of at ICDF without the need for further stabilization. At that time, a decision was made to macroencapsulate the waste residue within the sand filter and then dispose of both the sand filter and residual waste material as debris waste within the ICDF.

Calendar Year 2003 ERA activities associated with the sand filter involved a new visual inspection of the interior of the sand filter (to verify that the residual waste in the bottom of the filter box remained solid) and the removal and packaging of the sand filter (in preparation for its ultimate disposal at the ICDF). Details associated with these activities are discussed below.

The new visual inspection of the sand filter was performed using a remote video camera inserted through the top lid opening in the sand filter. Photographs taken from the video inspection are shown in Figure 9-1. Video inspection results found that waste residues retained in the bottom of the sand filter had remained solid without any observed "weeping" of liquid. As a result, the waste designation for the residue in the bottom of the sand filter can be considered acceptable for disposal at the ICDF without additional treatment. Following inspection, the sand filter was removed from its concrete pad within the AOC and packaged in plastic. The packaged sand filter is stored in a CERCLA temporary storage area at TAN awaiting its final disposition (including macroencapsulation) at the ICDF.

In addition to the sand filter, the AOC also had two abandoned concrete tank supports, located near TAN-616, that were in the way of the V-9 outlet pipe isolation. Radiological surveys of these solid concrete tank supports indicated that these materials were uncontaminated. As a result, the tank supports were removed from the OU 1-10 AOC and disposed of at the TAN demolition landfill.

Figure 9-1. Views of interior waste residue in the bottom of the sand filter.

9.2 Pipe Inspection and Isolation of Tank V-9

The only unisolated piping connection remaining on Tank V-9 in 2003 was the V-9 outlet pipe connecting Tank V-9 to the other V-Tanks (V-1, V-2, and V-3) through TAN-616. The inlet lines to Tank V-9 had already been removed as part of an earlier action performed in 1997 in advance of the WAG 1 ROD (DOE-ID 1999). Details associated with the V-9 outlet pipe inspection, cutting, and isolation activities performed in 2003 and 2004 are shown below.

As shown on facility drawings, the outlet line exiting the V-9 tank sloped towards the building into a header with isolation valves supplying the V-1, V-2, and V-3 storage tanks. Drawings also showed that the lines from the header to the storage tanks sloped towards the tanks. Previous internal video inspection of the V-9 tank indicated that liquid appeared to be level with the bottom of the V-9 outlet line. ERA project personnel decided to verify that the V-9 outlet line was free from liquids prior to excavation and cutting the line. To accomplish this, a camera inspection of the line was performed from inside TAN-616 via a partially demolished 3-in. drain penetrating the top of the 6-in outlet line just inside the TAN-616 wall (Figure 9-2). Work Order 66094 was generated to support and direct camera inspection of the V-9 tank outlet line. On April 24, 2003, a glove bag was installed over the riser and a small camera inserted into the line (Figure 9-3). The camera was directed into the header and pushed towards the V-9 tank. A small amount of liquid was discovered directly below the 3-in. drain line in the bottom of the 6-in. header. As the camera was directed into the outlet line, the depth of the liquid increased (Figure 9-4).

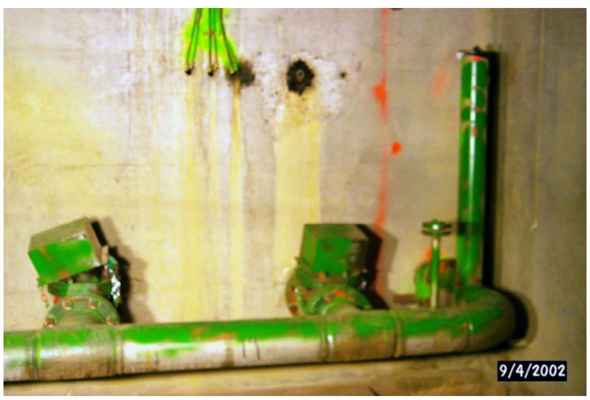

Figure 9-2. V-9 outlet header/riser.

Figure 9-3. Glove bag in place.

Figure 9-4. Liquid in V-9 outlet line.

At an estimated 7 ft outside the TAN-616 wall, the level in the outlet line submerged the camera lens approximately 1-1/2-in. The camera was retrieved, cleaned off, and directed into the V-Tank header towards the V-1, V-2, and V-3 isolation valves. No liquid was found in the header feeding the isolation valves. A small amount of debris was noted at the elbow entering into the V-3 isolation valve (Figure 9-5). The lower right corner of the figure is the bottom of the pipe showing a thin layer of sediment in the header.

Figure 9-5. V-3 tank inlet header.

Based on these findings, the project decided to insert a plug into the V-9 Tank outlet line after D&D work in TAN-616 removed the V-Tank isolation valve header. The plug was to be pushed into the line until it reached the solids separation Tee welded to the V-9 outlet line where it exited the V-9 tank. The plug was to remain in place and provide a barrier during V-Tank cleaning to prevent waste from entering the V-9 outlet line.

The project was not able to push the plug into the V-9 tank outlet line until February 3, 2004, primarily due to technical safety requirement (TSR) restrictions. Technical safety requirement 5.4.7.2 #19 located in TPR-1148, "Fissile Material Operations at the TAN Hot Shop, SES Room, TAN Hot Cell, and Storage," restricted personnel from introducing material into, or mixing of materials in the V-9 tank. The TSR requirement had to be deleted from TPR-1148; and SAR-208, "Safety Analysis Report for Test Area North Operations," required full implementation prior to pushing the plug.

Implementation of SAR-208 and removal of the TSR restrictions in TPR-1148 were completed in early January 2004. Decontamination and Decommissioning personnel disconnected and removed the V-1, V-2, and V-3 tanks inlet header in late January 2004. On February 3, 2004, the plug was pushed into the V-9 outlet line under Work Order 67689-04 for work control. The craftsman indicated that the plug insertion was relatively easy after the plug was started. At approximately 23 ft from the open flange inside the TAN-616 wall, significant resistance was encountered and pushing the plug was halted. After discussing the resistance, it was decided to discontinue pushing the plug due to the concern that additional force might damage the plug and cause leakage. It was determined that the plug was pushed to approximately 22 ft from the exterior of the TAN-616 wall. The plug appears to be about 10 ft from the V-9 tank.

When the “sticking” problem was discussed with engineering personnel at a later date, one individual remembered seeing a drawing (Drawing No. 138651 1-C, release date November 3, 1982) showing the V-9 outlet line isolated and capped near the V-9 tank. Apparently this drawing was either missed or not considered valid when the composite drawing (Figure 5-1) was developed.

The plugging activity indicated that increased resistance encountered while pushing the plug may have been the result of air/water pressure buildup as the plug neared the end of the capped line. However, the status of the V-9 outlet line will not be known until it is excavated for isolation and removal later in 2004. The plug, left as is, still provides adequate isolation of waste in the line to permit D&D personnel to cut and cap the line near the TAN-616 wall, thus allowing further D&D of the building. Any residual material left in the capped outlet line will have to be removed via a hot tapping of the pie contents when the outlet pipe is removed from the AOC. The outlet pipe removal is to be completed as Phase 1 of the contaminated soil excavation activity for V-Tank waste consolidation to be conducted in late 2004.

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11. DRAWINGS

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